NIDEK

# AR-600/ARK-700 SERIES

# SERVICE MANUAL

FOR AR-600 ARK-700
AR-600A ARK-700A
AR-660A ARK-760A

NIDEK CO., LTD.

MAR10*RTZ001C/E
Total Page: 164
2003. 12

# *Table of Contents*


**§1 INTRODUCTION ..... 1-1**

**§2 CAUTION ..... 2-1**

2.1 Check flows and items to be checked ..... 2-2

**§3 TROUBLESHOOTING ..... 3-1**

3.1 The TV monitor display nothing/the monitor display is abnormal ..... 3-1

3.2 The message “Err” appears after turning ON the Power Switch ..... 3-2

3.2.1 “Err 1” (Sensor carry error) appears ..... 3-2

3.2.2 “Err 2” (Chart carry error) appears ..... 3-3

3.2.3 “Err 3” (rotary error) appears ..... 3-4

3.2.4 “Err 4” (Chart error) appears ..... 3-5

3.2.5 “Err 5”(CL1 error) or “Err 6” (CL2 error) appears ..... 3-5

3.2.6 “Err 7”([line] printer error) appears ..... 3-6

3.2.7 “Err 8”([serial] printer error)appears ..... 3-6

3.2.8 “Err 9” (MEMORY FAILURE ON E2PROM) appears ..... 3-7

3.2.9 “Err A” (MEMORY FAILURE ON RAM) appears ..... 3-7

3.2.10 “PD ERR” appears ..... 3-8

3.3 The shutter does not open (only for AR-600 whose S/N is earlier than 10121) ..... 3-9

3.4 The raster does not appear (The TV monitor does not light well) ..... 3-9

3.5 Eye image does not appear on the TV monitor ..... 3-9

3.6 The characters or target are not clear or they do not appear on the TV monitor .... 3-10

3.7 The switching between the manual mode and auto-tracking mode can not be done .... ..... 3-10

3.8 The instrument can not be placed into the mode where the objective measurement is performed. ..... 3-10

3.9 The parameter settings can not be changed ..... 3-11

3.10 The measuring mode can not be changed ..... 3-12

3.11 The movement of the measuring unit is not smooth on a plane ..... 3-12

3.12 The vertical movement of the measuring unit is not smooth ..... 3-12

3.13 The measuring unit is unstable ..... 3-13

3.14 The alignment light does not appear (only for AR-600 series) ..... 3-13

3.15 The Mire Ring does not appear (only for ARK-700 series) ..... 3-13

3.16 The model eye image is not clear ..... 3-14

3.17 AR measurement does not start ..... 3-14

3.18 The message “Err” appears during AR measurements ..... 3-15

3.19 Only the obtained SPH value is shifted ..... 3-16

3.20 The obtained CYL value is too high ..... 3-17

3.21 A short beep can not be heard when pressing the Start button ..... 3-18

3.22 The IOL mode can not be turned ON ..... 3-18
3.23 The Cylinder mode can not be changed ..... 3-18
3.24 The instrument can not recognize the left and right ..... 3-19
3.25 The instrument can not be placed in the PD mode ..... 3-19
3.26 The obtained PD value is abnormal ..... 3-20
3.27 The message “Err” appears during KM measurement ..... 3-20
3.28 The obtained KM value is abnormal ..... 3-20
3.29 The up-and-down movement of the Chin rest is not smooth ..... 3-21
3.30 The charts can not be seen ..... 3-21
3.31 “Err” does not appear though the patient blinked during measurement ..... 3-22
3.32 The auto-tracking function does not work ..... 3-23
3.33 The auto-shot function does not work ..... 3-24
3.34 The instrument can not be placed in the VA TEST mode where the subjective measurement is done ..... 3-24
3.35 VA charts can not be changed ..... 3-25
3.36 The presented chart is out of focus during the subjective measurement (except when a patient has irregular astigmatism) ..... 3-25
3.37 The message “Err IF” (Interface error) appears ..... 3-26
3.38 The printer does not operate ..... 3-27
3.39 Light printed text/loss of text ..... 3-27
3.40 The Eyeprint function can not be turned On ..... 3-28
3.41 The TV auto-OFF function does not work ..... 3-28
3.42 The shutter does not close (only for the instruments whose S/N earlier than 10121) ..... 3-28

**§4 Checking the obtained data with Model eyes ..... 4-1**
4.1 Cleaning the Model eyes and Steel balls ..... 4-1
4.2 Cleaning the measuring window ..... 4-2
4.3 Measuring the Model eyes ..... 4-3
4.4 Tolerance on AR measurement error ..... 4-3
4.5 Measuring the Steel balls ..... 4-4
4.6 Tolerance on KM measurement error ..... 4-4

**§5 Removing covers ..... 5-1**
5.1 Removing the Front, Left and Right covers ..... 5-1
5.2 Removing the Rear cover of the measuring unit ..... 5-3
5.3 Removing the Inner cover ..... 5-3
5.4 Removing the Rear cover ..... 5-4
5.5 Removing the TV panel ..... 5-5
5.6 Removing the bottom plate of the instrument ..... 5-6

**§6 Checking the mains supply condition ..... 6-1**
6.1 Checking the supply voltage to AC INLET ..... 6-1
6.2 Checking the secondary voltage of the transformer ..... 6-1
6.3 Checking output voltage on PC7 board ..... 6-2
6.4 Checking output voltage from backup battery ..... 6-2
6.5 Checking voltage in D1 and D2 on the PC6 board ..... 6-3

§7 **Checking continuity of switches ..... 7-1**
7.1 START SW ..... 7-1
7.2 Switches on the PC2 board ..... 7-1
7.3 Switches on the PC3 board (except AR-600) ..... 7-3
7.4 Switches on the PC12 board (only for AR-660A and ARK-760A) ..... 7-4

§8 **Checking electric parts ..... 8-1**
8.1 Checking origin sensor for the chart carry ..... 8-1
8.2 Checking L/R origin sensor (except AR-600 & ARK-700) ..... 8-2
8.3 Checking the Origin sensor for the Rotator ..... 8-3
8.4 AR measurement LED and LED cable ..... 8-4
8.5 Checking the ILLUMI. LED voltage ..... 8-5
8.6 Checking the Chart lamp voltage ..... 8-5
8.7 Checking the alignment light LED voltage ..... 8-5
8.8 Checking the PD LED voltage ..... 8-5
8.9 Checking the FOCUS LED voltage (only for AR-600A, AR-660A) ..... 8-6
8.10 Checking the AKM LED voltage (only for AR-700 series) ..... 8-6
8.11 Checking the AKM LED voltage (except AR-600) ..... 8-6

§9 **Replacing circuit boards ..... 9-1**
9.1 Replacing PC1 (MAIN) board ..... 9-1
9.2 Replacing PC2 (DISPLAY) board ..... 9-2
9.3 Replacing PC3 (INC.DEC SW) board (except AR-600) ..... 9-3
9.4 Replacing PC6 (ADJUST) board ..... 9-4
9.5 Replacing PC7 (POWER SUPPLY) board ..... 9-5
9.6 Replacing PC8 (PRINTER) board and printer ..... 9-6
9.7 Replacing PC10 (MIRE) board ..... 9-8
9.8 Replacing PC12 (CHART SELECT SW) board ..... 9-10
9.9 Replacing the PC22 (TRACKING) board ..... 9-11
9.10 Replacing the PC23 (PD CCD) board ..... 9-12
9.11 Replacing the PC24 (PD LED) board ..... 9-13

§10 **Replacing parts ..... 10-1**
10.1 Replacing the transformer ..... 10-1
10.2 Replacing the Joystick ..... 10-2
10.3 Cleaning and replacing the Slide plate ..... 10-3
10.4 Replacing LED and cleaning IR filter ..... 10-4
10.5 Replacing LED and cleaning of the G29 ..... 10-5
10.6 Replacing the Front cover ..... 10-6
10.7 Replacing the FOCUS LED ..... 10-7
10.8 Replacing the Shutter ..... 10-8
10.9 Replacing the LED cable ..... 10-9
10.10 Replacing the Chart lamp ..... 10-10
10.11 Replacing the Chart carry limit sensor ..... 10-11
10.12 Replacing the Rotator unit origin sensor ..... 10-12
10.13 Replacing U/D limit switches ..... 10-13
10.14 Replacing the Left and Right limit sensor unit ..... 10-15
10.15 Replacing the U/D Motor

(for moving the measurement unit up and down) (Except AR-600) ..... 10-16
10.16 Replacing the R/L motor (For moving the instrument to the right or left)
(Except AR-600 and ARK-700) ..... 10-17
10.17 Replacing the TV Monitor ..... 10-18
10.18 Replacing the CCD camera ..... 10-19
10.19 Replacing the Chart unit ..... 10-20
10.20 Replacing CYL unit (Only for AR-660A and ARK-760A) ..... 10-21
10.21 Replacing the Battery ..... 10-22
10.22 Replacing the Measuring unit ..... 10-23

**§11 Adjusting each part ..... .11-1**
11.1 Adjusting the tightness of roller bearing (#67) for up-and-down shaft ..... 11-1
11.2 Adjusting the Sway stopper unit ..... 11-3
11.3 Adjusting the up-and-down movement of the Chin rest ..... 11-4
11.4 Calibrating by adjusting the focus of CCD camera lens ..... 11-6
11.5 Positioning the target square ..... 11-7
11.6 Sensor calibration (adjusting VR1 and VR2 on the PC6 board) ..... 11-8
11.7 KM auto-calibration (only for ARK-700 series) ..... 11-10
11.8 Setting EEPROM DATA ..... 11-12
11.8.1 Setting Sensor Offset (SO) ..... 11-13
11.8.2 Setting Print Density (PC) ..... 11-14
11.8.3 Setting Target Offset (TO) ..... 11-15
11.8.4 Setting Target Gain (TG) ..... 11-15
11.8.5 Setting PD Gain (PA) ..... 11-16
11.8.6 Setting Mask Blink Level (ML) ..... 11-16
11.8.7 Setting Horizontal Position (HP) of display ..... 11-17
11.8.8 Setting Vertical Position (VP) of display ..... 11-17
11.8.9 Adjusting scale for CS (Corneal Size) measurement
(only for ARK-700 series) ..... 11-18
11.8.10 Setting CYL zero (C1) and CYL axis (C2)
(Only for AR-660A and ARK-760) ..... 11-20
11.9 Adjusting image centering ..... 11-21
11.10 Adjusting Brightness and Sharpness of display ..... 11-22
11.11 Tracking auto-calibration (except AR-600 and ARK-700) ..... 11-23

**§12 Program for adjustment ..... 12-1**

**§13 Replacing ROM (Program) ..... 13-1**

**§14 List of SW 1 and SW2 operations ..... 14-1**

**§15 Principle of Measurement ..... 15-1**

**§16 References ..... 16-1**
• AR-600 CONSTRUCTION DRAWING ..... 16-1
• AR-600 WIRING DIAGRAM ..... 16-3
• AR-600A CONATRUCTION DRAWING ..... 16-4
• AR-600A WIRING DIAGRAM ..... 16-6
• AR-660A CONSTRUCTION DRAWING ..... 16-7

• AR-660A WIRING DIAGRAM ..... 16-9
• ARK-700 CONSTRUCITON DRAWING ..... 16-10
• ARK-700 WIRING DIAGRAM ..... 16-12
• ARK-700A CONSTRUCTION DRAWING ..... 16-13
• ARK-700A WIRNG DIAGRAM ..... 16-15
• ARK-760A CONSTRUCTION DRAWING ..... 16-16
• ARK-760A WIRING DIAGRAM ..... 16-18
• AR-600, ARK-700 SERIES WIRING DIAGRAM ..... 16-19
• AR-600, ARK-700 SERIES CONNECTOR TABLE ..... 16-22
• ERROR CODE CHART ..... 16-28

# §1 INTRODUCTION

- This manual provides information on after-sales servicing procedures of NIDEK AUTO REFRACTOMETER AR-600 series and AUTO REF/KERATOMETER ARK-700 series.

- For correct after-sales service, it is necessary to understand this manual thoroughly before service.

- If the instrument cannot be repaired by following the procedures described in this manual, contact NIDEK or your authorized distributor and let us know the serial number and details of the symptom. If it is possible to obtain measurements in the condition, also send us the data obtained by measuring with the model eye (-10D, 0D, +10D) and steel balls (5.95mm, 7.94mm and 9.13mm).

# §2 TROUBLESHOOTING

- For correct after-sales service, follow the procedures described in “2.1 Check flows and items to be checked” of this manual. For operating procedure, refer to “Operator’s Manual” for each instrument.

- If you encounter any abnormal condition, track down the failure’s source as described in “3 TROUBLESHOOTING” and then immediately turn OFF the Power Switch of the instrument.

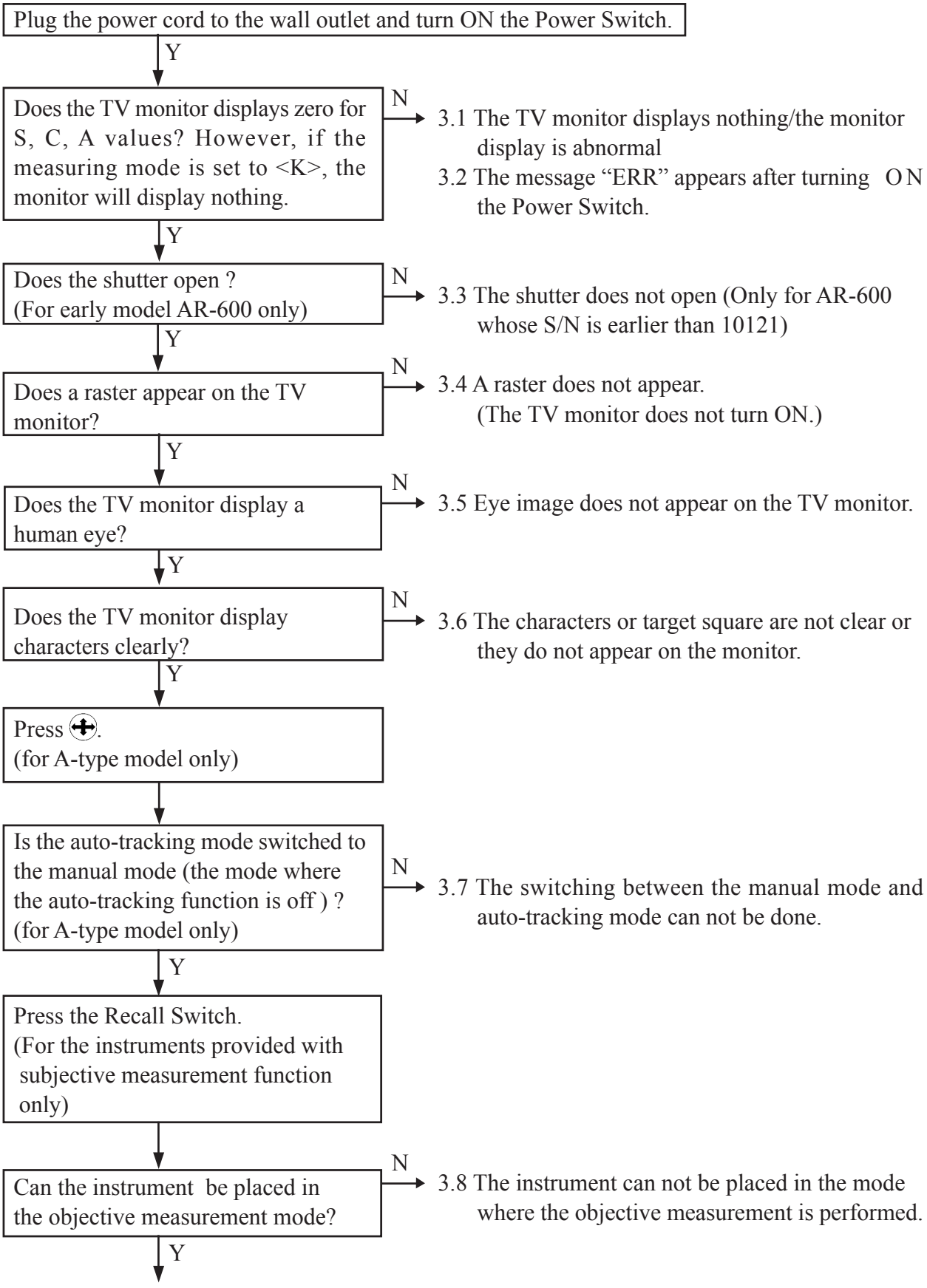
- Before disassembling the instrument, be sure to turn OFF the Power Switch and disconnect the power cord from the wall outlet.

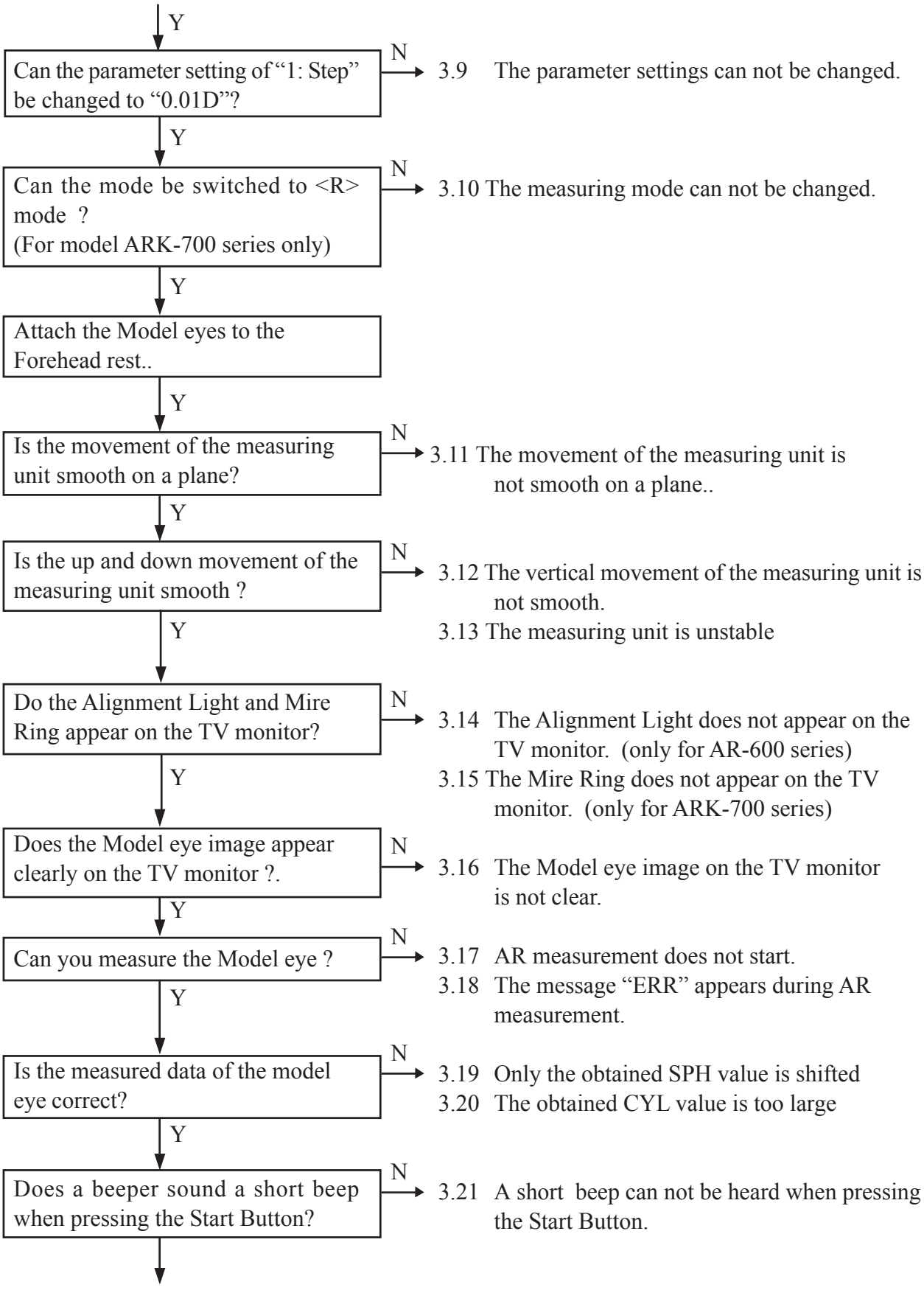
- In “3 TROUBLESHOOTING”, check the following for cables, referring to the attached WIRING DIAGRAM and CONNECTOR TABLE.
  ① All the connectors are connected or crimped securely.
  ② There is no contact failure of connectors.
  (Check by connecting or disconnecting them.)
  ③ The cable has no break.
  Take care not to strain the cable.

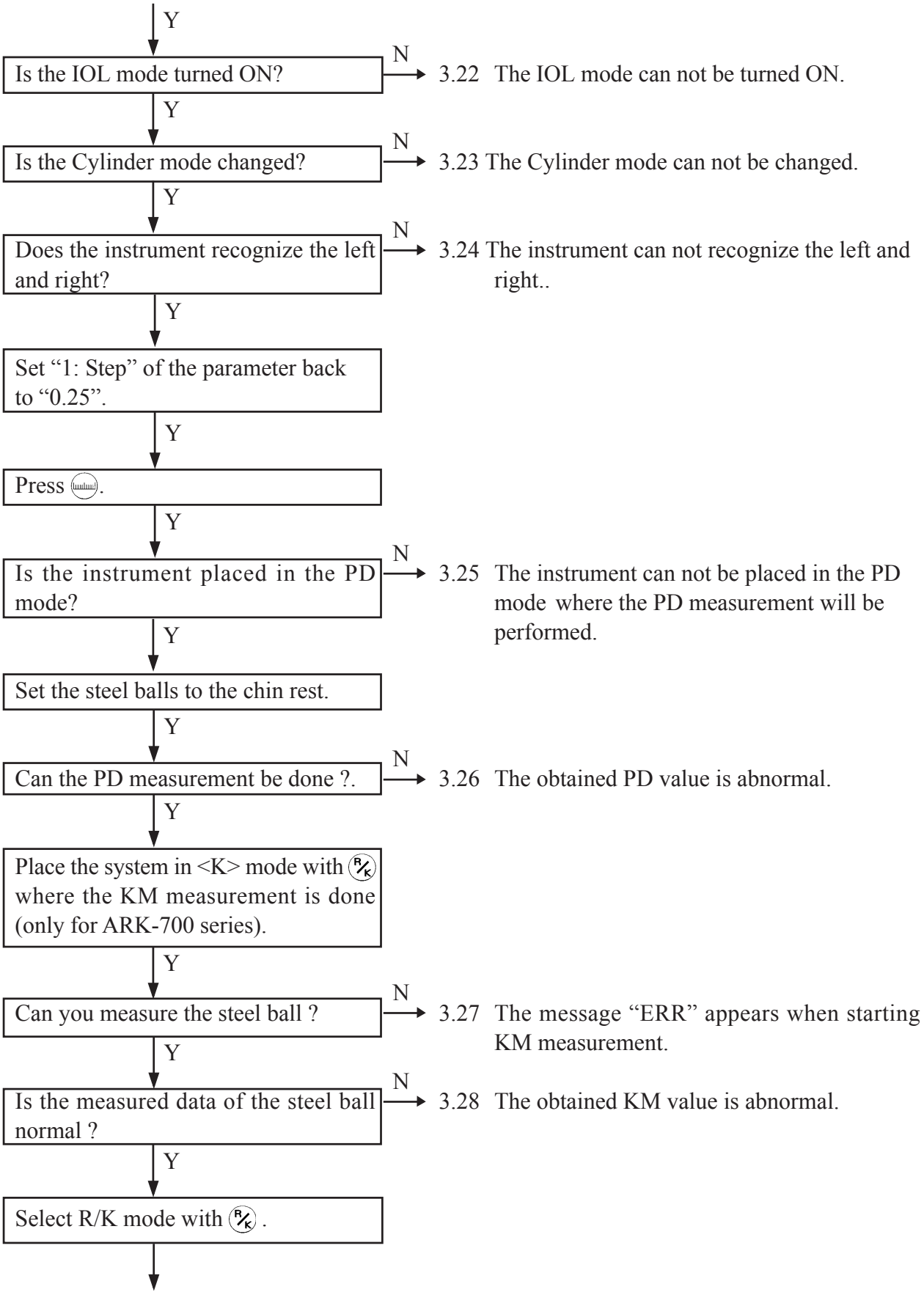
- Take care not to lose the removed screws or parts, or not to drop them inside the instrument.

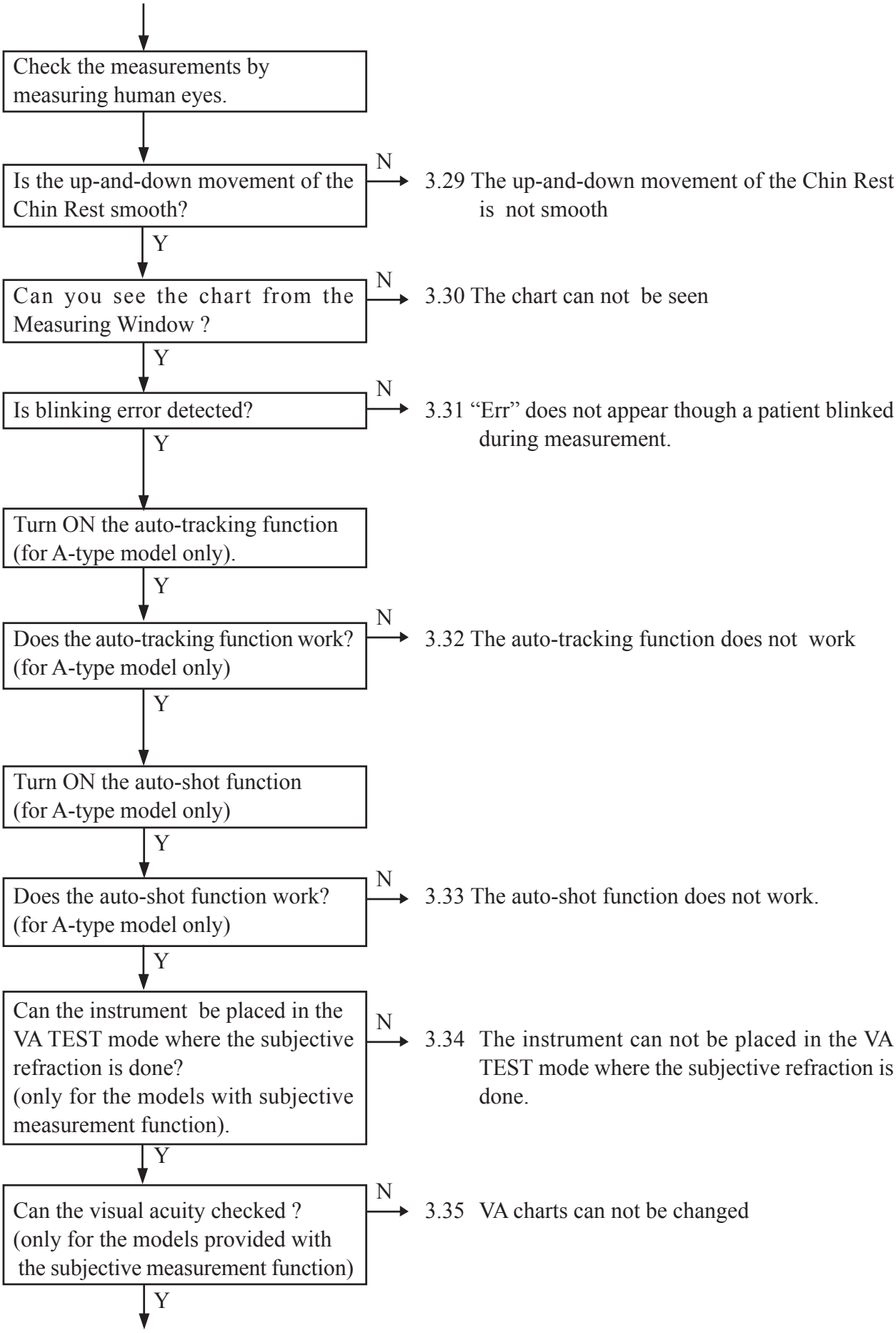
- Be sure to apply Locktight to the fixed screws.

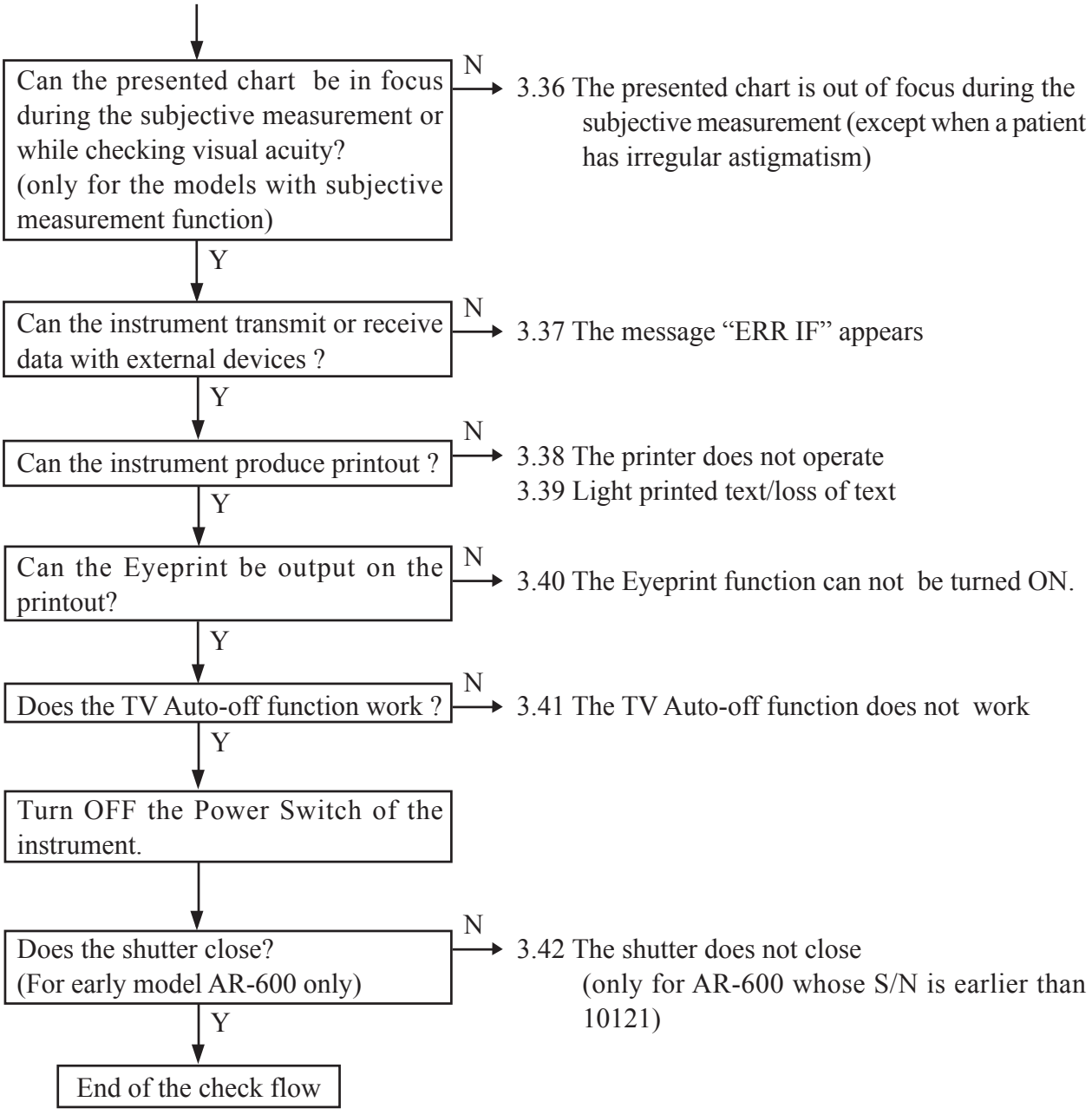
## 2.1 Check flow and items to be checked


Plug the power cord to the wall outlet and turn ON the Power Switch.
Y
Does the TV monitor displays zero for S, C, A values? However, if the measuring mode is set to <K>, the monitor will display nothing.
N
3.1 The TV monitor displays nothing/the monitor display is abnormal
3.2 The message "ERR" appears after turning ON the Power Switch.
Y
Does the shutter open ? (For early model AR-600 only)
N
3.3 The shutter does not open (Only for AR-600 whose S/N is earlier than 10121)
Y
Does a raster appear on the TV monitor?
N
3.4 A raster does not appear. (The TV monitor does not turn ON.)
Y
Does the TV monitor display a human eye?
N
3.5 Eye image does not appear on the TV monitor.
Y
Does the TV monitor display characters clearly?
N
3.6 The characters or target square are not clear or they do not appear on the monitor.
Y
Press .
(for A-type model only)
Is the auto-tracking mode switched to the manual mode (the mode where the auto-tracking function is off ) ? (for A-type model only)
N
3.7 The switching between the manual mode and auto-tracking mode can not be done.
Y
Press the Recall Switch.
(For the instruments provided with subjective measurement function only)
Can the instrument be placed in the objective measurement mode?
N
3.8 The instrument can not be placed in the mode where the objective measurement is performed.
Y

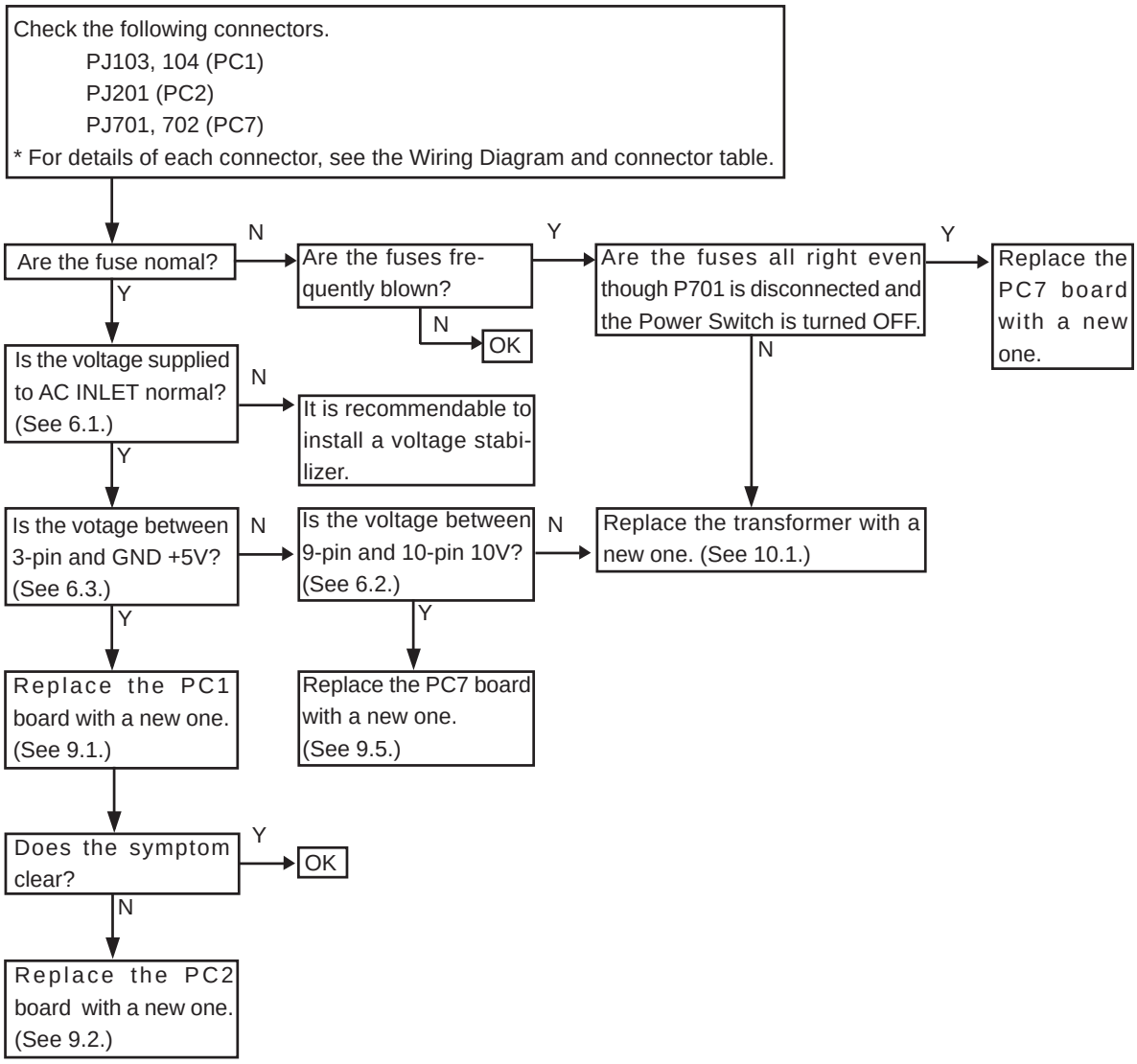

Y
Can the parameter setting of "1: Step" be changed to "0.01D"?
N
3.9 The parameter settings can not be changed.
Y
Can the mode be switched to <R> mode ?
(For model ARK-700 series only)
N
3.10 The measuring mode can not be changed.
Y
Attach the Model eyes to the Forehead rest..
Y
Is the movement of the measuring unit smooth on a plane?
N
3.11 The movement of the measuring unit is not smooth on a plane..
Y
Is the up and down movement of the measuring unit smooth ?
N
3.12 The vertical movement of the measuring unit is not smooth.
3.13 The measuring unit is unstable
Y
Do the Alignment Light and Mire Ring appear on the TV monitor?
N
3.14 The Alignment Light does not appear on the TV monitor. (only for AR-600 series)
3.15 The Mire Ring does not appear on the TV monitor. (only for ARK-700 series)
Y
Does the Model eye image appear clearly on the TV monitor ?.
N
3.16 The Model eye image on the TV monitor is not clear.
Y
Can you measure the Model eye ?
N
3.17 AR measurement does not start.
3.18 The message "ERR" appears during AR measurement.
Y
Is the measured data of the model eye correct?
N
3.19 Only the obtained SPH value is shifted
3.20 The obtained CYL value is too large
Y
Does a beeper sound a short beep when pressing the Start Button?
N
3.21 A short beep can not be heard when pressing the Start Button.


Y
Is the IOL mode turned ON?
N
3.22 The IOL mode can not be turned ON.
Y
Is the Cylinder mode changed?
N
3.23 The Cylinder mode can not be changed.
Y
Does the instrument recognize the left and right?
N
3.24 The instrument can not recognize the left and right..
Y
Set "1: Step" of the parameter back to "0.25".
Y
Press .
Y
Is the instrument placed in the PD mode?
N
3.25 The instrument can not be placed in the PD mode where the PD measurement will be performed.
Y
Set the steel balls to the chin rest.
Y
Can the PD measurement be done ?.
N
3.26 The obtained PD value is abnormal.
Y
Place the system in <K> mode with R/K where the KM measurement is done (only for ARK-700 series).
Y
Can you measure the steel ball ?
N
3.27 The message "ERR" appears when starting KM measurement.
Y
Is the measured data of the steel ball normal ?
N
3.28 The obtained KM value is abnormal.
Y
Select R/K mode with R/K .


Check the measurements by measuring human eyes.
Is the up-and-down movement of the Chin Rest smooth?
N
3.29 The up-and-down movement of the Chin Rest is not smooth
Y
Can you see the chart from the Measuring Window ?
N
3.30 The chart can not be seen
Y
Is blinking error detected?
N
3.31 "Err" does not appear though a patient blinked during measurement.
Y
Turn ON the auto-tracking function (for A-type model only).
Y
Does the auto-tracking function work? (for A-type model only)
N
3.32 The auto-tracking function does not work
Y
Turn ON the auto-shot function (for A-type model only)
Y
Does the auto-shot function work? (for A-type model only)
N
3.33 The auto-shot function does not work.
Y
Can the instrument be placed in the VA TEST mode where the subjective refraction is done? (only for the models with subjective measurement function).
N
3.34 The instrument can not be placed in the VA TEST mode where the subjective refraction is done.
Y
Can the visual acuity checked ? (only for the models provided with the subjective measurement function)
N
3.35 VA charts can not be changed
Y


Can the presented chart be in focus during the subjective measurement or while checking visual acuity?
(only for the models with subjective measurement function)
N
3.36 The presented chart is out of focus during the subjective measurement (except when a patient has irregular astigmatism)
Y
Can the instrument transmit or receive data with external devices ?
N
3.37 The message "ERR IF" appears
Y
Can the instrument produce printout ?
N
3.38 The printer does not operate
3.39 Light printed text/loss of text
Y
Can the Eyeprint be output on the printout?
N
3.40 The Eyeprint function can not be turned ON.
Y
Does the TV Auto-off function work ?
N
3.41 The TV Auto-off function does not work
Y
Turn OFF the Power Switch of the instrument.
Does the shutter close?
(For early model AR-600 only)
N
3.42 The shutter does not close
(only for AR-600 whose S/N is earlier than 10121)
Y
End of the check flow

# 3.1 The TV monitor displays nothing/the monitor display is abnormal

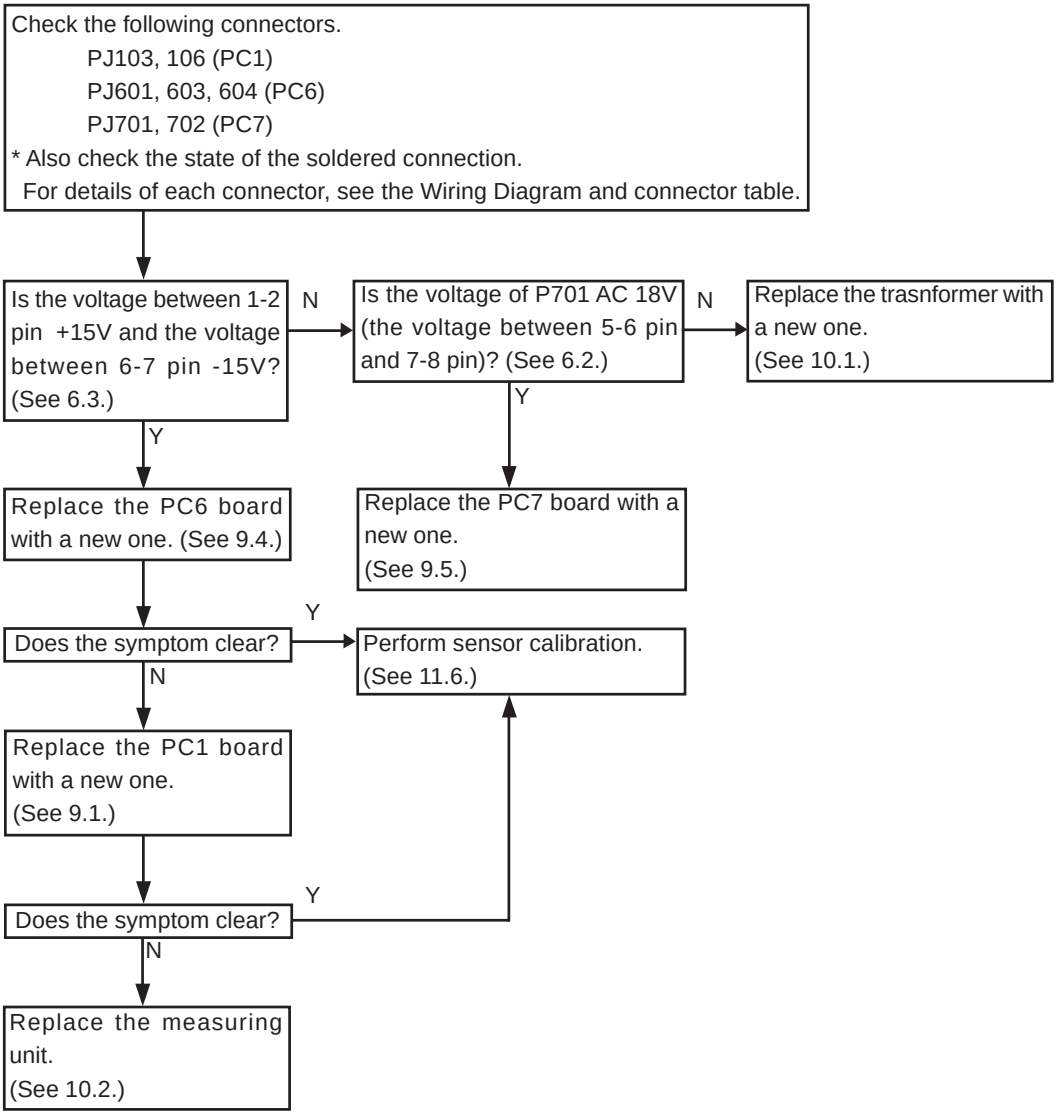

Check the following connectors.
PJ103, 104 (PC1)
PJ201 (PC2)
PJ701, 702 (PC7)
* For details of each connector, see the Wiring Diagram and connector table.
Are the fuse nomal?
N
Are the fuses frequently blown?
Y
Are the fuses all right even though P701 is disconnected and the Power Switch is turned OFF.
Y
Replace the PC7 board with a new one.
Y
N
OK
Is the voltage supplied to AC INLET normal? (See 6.1.)
N
It is recommendable to install a voltage stabilizer.
Y
Is the votage between 3-pin and GND +5V? (See 6.3.)
N
Is the voltage between 9-pin and 10-pin 10V? (See 6.2.)
N
Replace the transformer with a new one. (See 10.1.)
Y
Y
Replace the PC1 board with a new one. (See 9.1.)
Replace the PC7 board with a new one. (See 9.5.)
Does the symptom clear?
Y
OK
N
Replace the PC2 board with a new one. (See 9.2.)

# 3.2 The message “Err” appears after turning ON the Power Switch

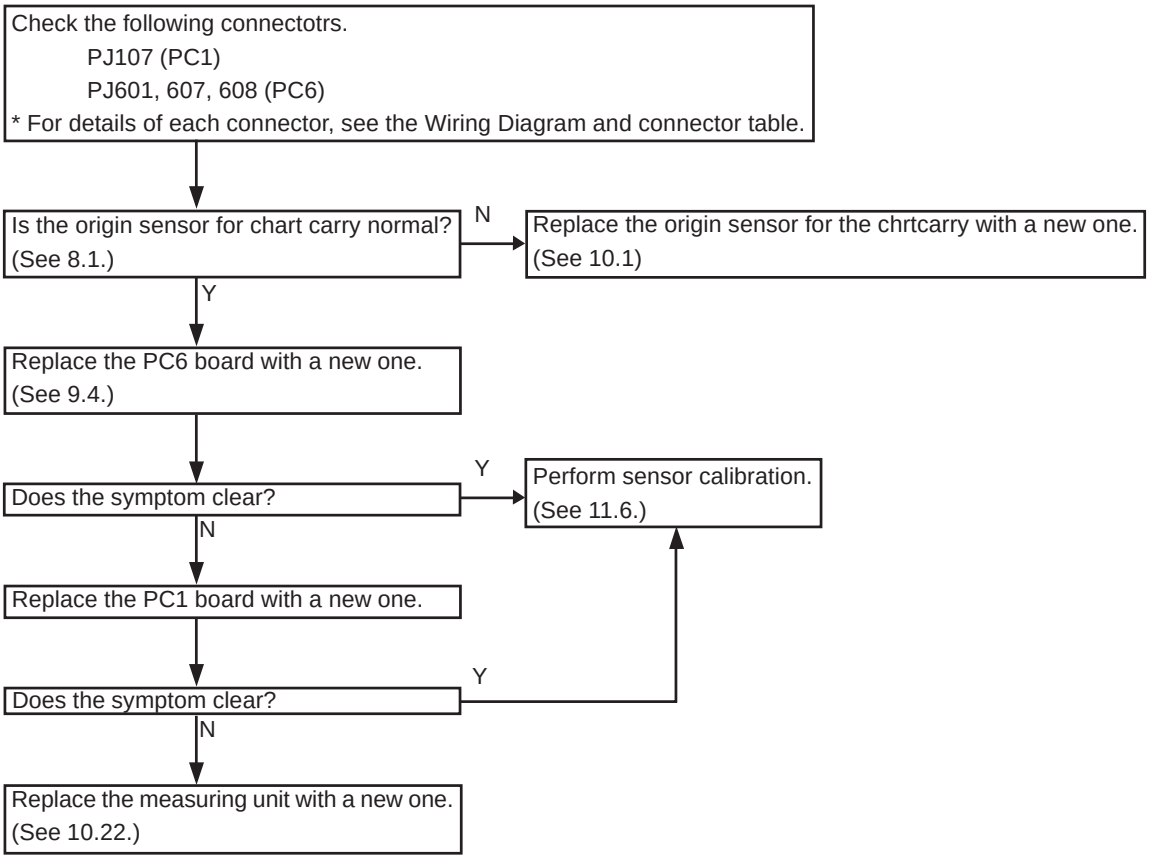
* If the message “Err” appears after turning ON the Power Switch, set the following parameter to “YES”, following the instructions in Operator’s Manual.

For AR-600 series (PARAMETERS 33: Err Code YES)
For ARK-700 series (PARAMETERS 37: Err Code YES)

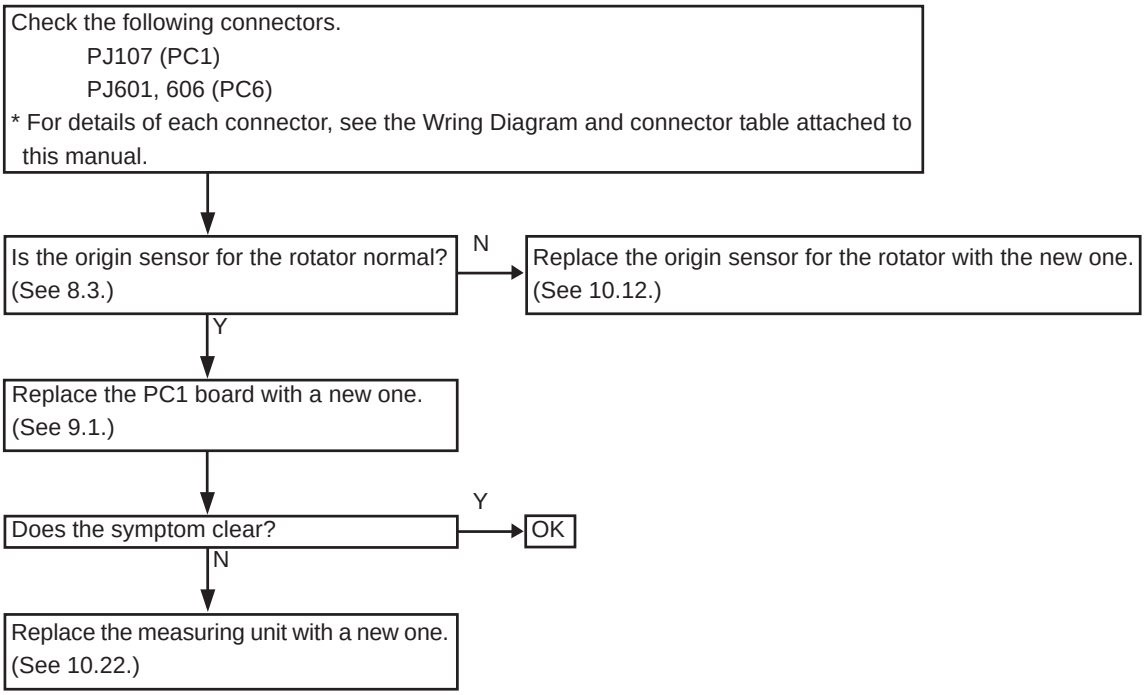
## 3.2.1 “Err 1” (Sensor carry error) appears.


Check the following connectors.
PJ103, 106 (PC1)
PJ601, 603, 604 (PC6)
PJ701, 702 (PC7)
* Also check the state of the soldered connection.
For details of each connector, see the Wiring Diagram and connector table.
Is the voltage between 1-2 pin +15V and the voltage between 6-7 pin -15V? (See 6.3.)
N
Is the voltage of P701 AC 18V (the voltage between 5-6 pin and 7-8 pin)? (See 6.2.)
N
Replace the trasnformer with a new one. (See 10.1.)
Y
Y
Replace the PC6 board with a new one. (See 9.4.)
Replace the PC7 board with a new one. (See 9.5.)
Y
Does the symptom clear?
Perform sensor calibration. (See 11.6.)
N
Replace the PC1 board with a new one. (See 9.1.)
Y
Does the symptom clear?
N
Replace the measuring unit. (See 10.2.)

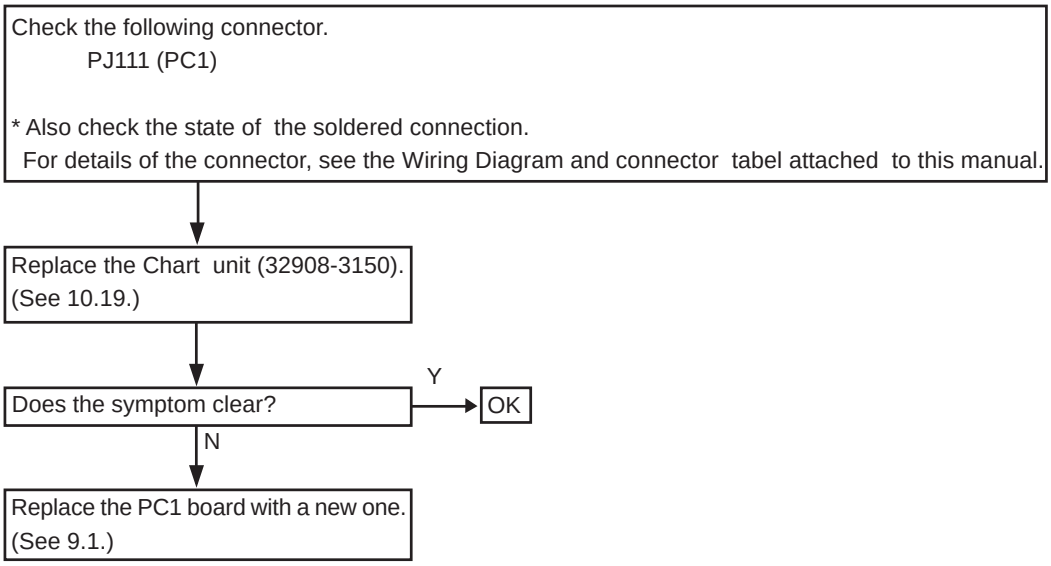
# 3.2.2 “Err2” (Chart carry error) appears.


Check the following connectotrs.
PJ107 (PC1)
PJ601, 607, 608 (PC6)
* For details of each connector, see the Wiring Diagram and connector table.
Is the origin sensor for chart carry normal? (See 8.1.)
N
Replace the origin sensor for the chrtcarry with a new one. (See 10.1)
Y
Replace the PC6 board with a new one. (See 9.4.)
Does the symptom clear?
Y
Perform sensor calibration. (See 11.6.)
N
Replace the PC1 board with a new one.
Does the symptom clear?
Y
N
Replace the measuring unit with a new one. (See 10.22.)

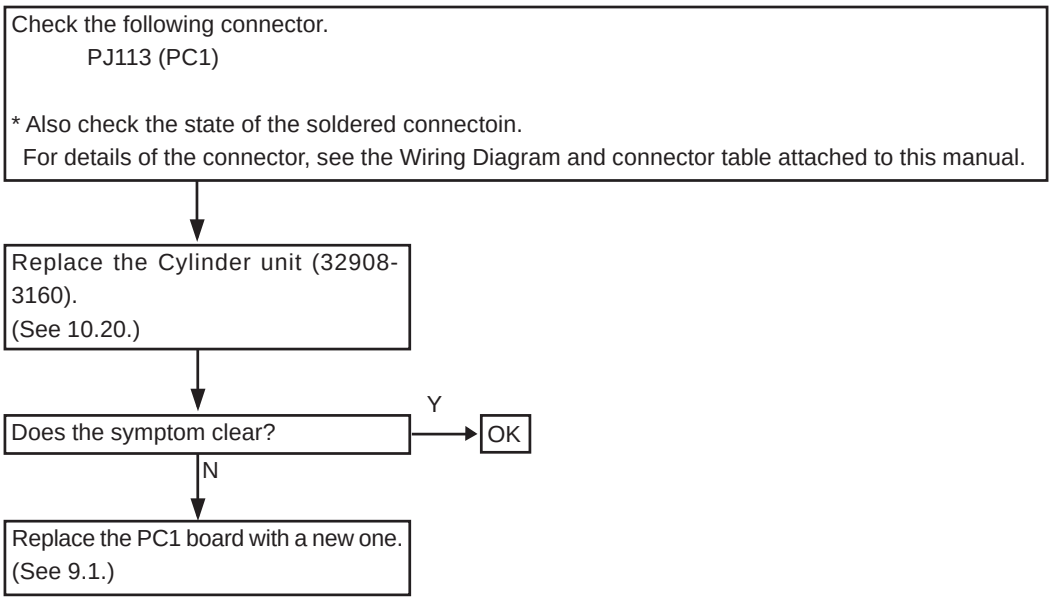
## 3.2.3 “Errr 3” (Rotator error) appears.


Check the following connectors.
PJ107 (PC1)
PJ601, 606 (PC6)
* For details of each connector, see the Wring Diagram and connector table attached to this manual.
Is the origin sensor for the rotator normal? (See 8.3.)
N
Replace the origin sensor for the rotator with the new one. (See 10.12.)
Y
Replace the PC1 board with a new one. (See 9.1.)
Does the symptom clear?
Y
OK
N
Replace the measuring unit with a new one. (See 10.22.)

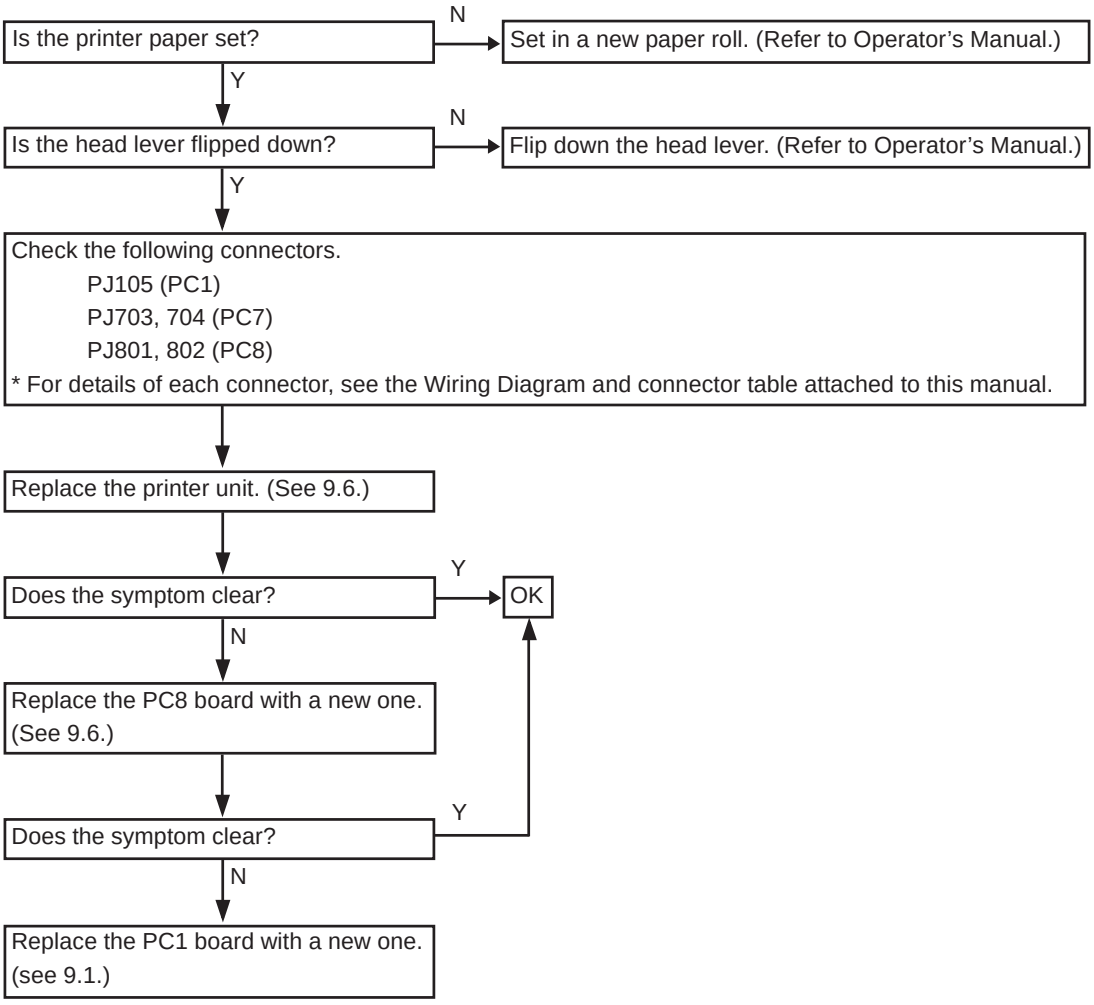
## 3.2.4 “Err 4” (Chart error) appears.


Check the following connector.
PJ111 (PC1)
* Also check the state of the soldered connection.
For details of the connector, see the Wiring Diagram and connector tabel attached to this manual.
Replace the Chart unit (32908-3150).
(See 10.19.)
Does the symptom clear?
Y
OK
N
Replace the PC1 board with a new one.
(See 9.1.)

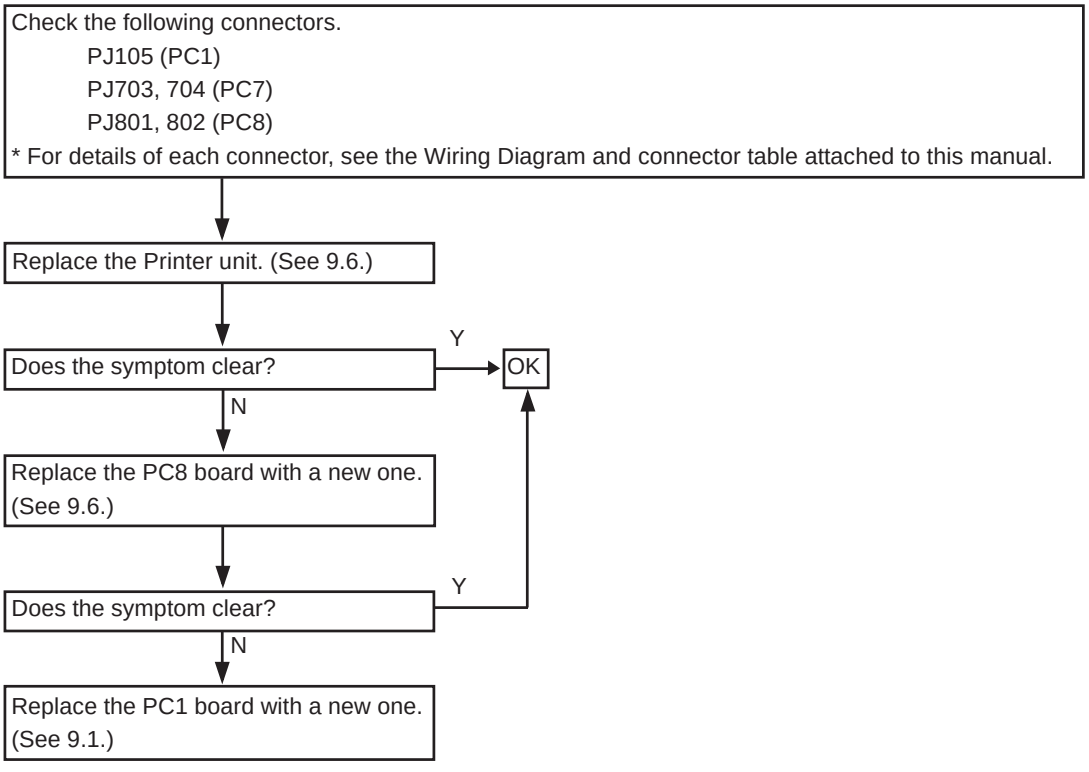
## 3.2.5 “Err 5” (CL1 error) or “Err 6” (CL2 error) appears.


Check the following connector.
PJ113 (PC1)
* Also check the state of the soldered connectoin.
For details of the connector, see the Wiring Diagram and connector table attached to this manual.
Replace the Cylinder unit (32908-3160).
(See 10.20.)
Does the symptom clear?
Y
OK
N
Replace the PC1 board with a new one.
(See 9.1.)

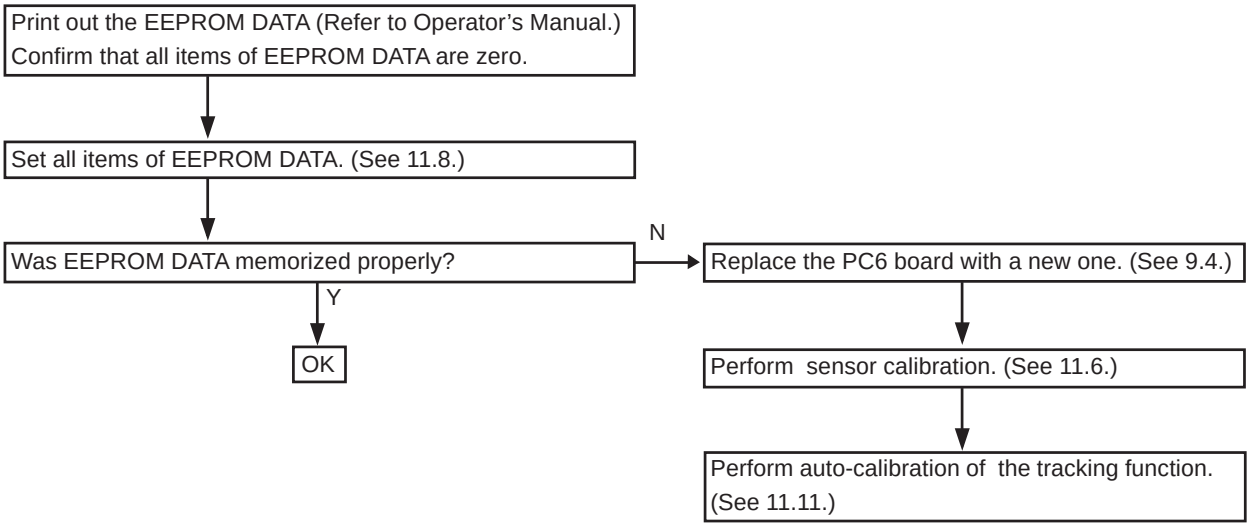
## 3.2.6 “Err 7” ([line] printer error) appears.


Is the printer paper set?
N
Set in a new paper roll. (Refer to Operator’s Manual.)
Y
Is the head lever flipped down?
N
Flip down the head lever. (Refer to Operator’s Manual.)
Y
Check the following connectors.
PJ105 (PC1)
PJ703, 704 (PC7)
PJ801, 802 (PC8)
* For details of each connector, see the Wiring Diagram and connector table attached to this manual.
Replace the printer unit. (See 9.6.)
Does the symptom clear?
Y
OK
N
Replace the PC8 board with a new one. (See 9.6.)
Does the symptom clear?
Y
N
Replace the PC1 board with a new one. (see 9.1.)

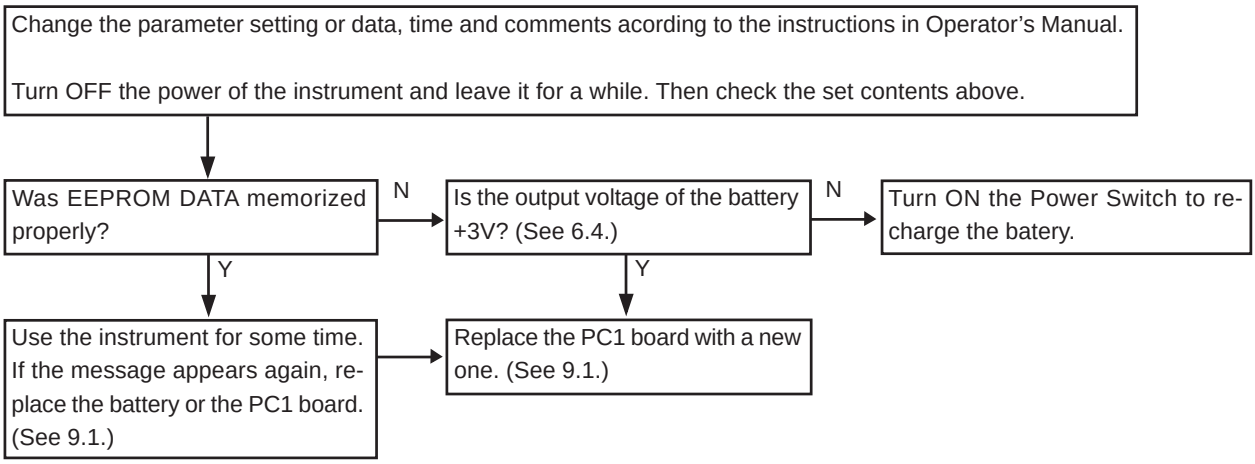
## 3.2.7 “Err 8” ([serial] printer error) appears.


Check the following connectors.
PJ105 (PC1)
PJ703, 704 (PC7)
PJ801, 802 (PC8)
* For details of each connector, see the Wiring Diagram and connector table attached to this manual.
Replace the Printer unit. (See 9.6.)
Does the symptom clear?
Y
OK
N
Replace the PC8 board with a new one. (See 9.6.)
Does the symptom clear?
Y
N
Replace the PC1 board with a new one. (See 9.1.)

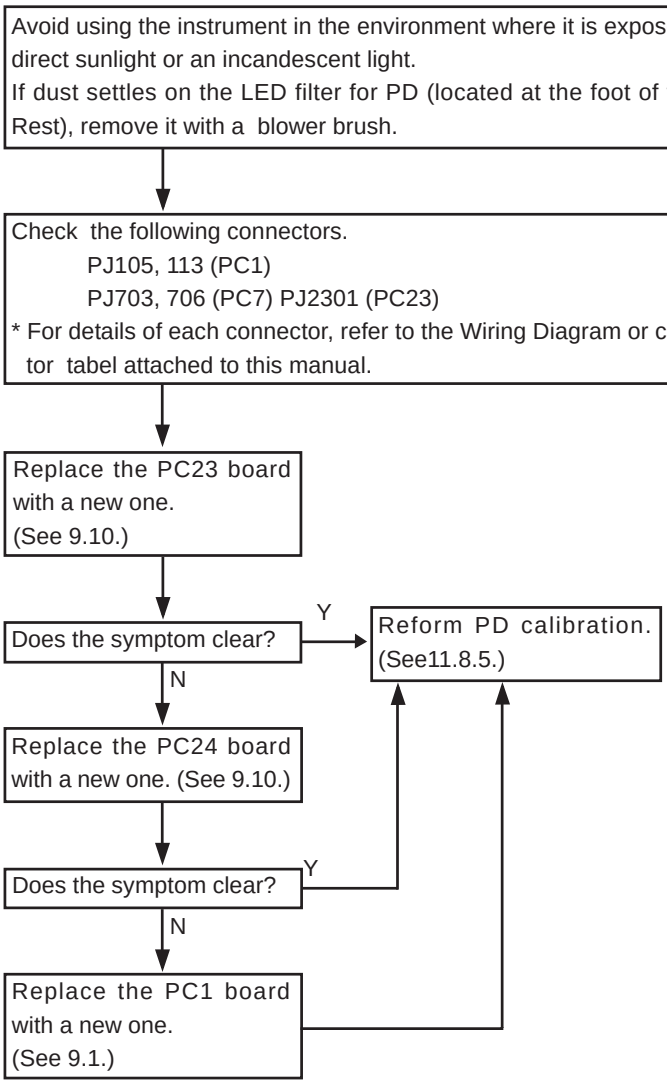
## 3.2.8 “Err 9” (MEMORY FAILURE ON EEPROM) appears.


Print out the EEPROM DATA (Refer to Operator’s Manual.)
Confirm that all items of EEPROM DATA are zero.
Set all items of EEPROM DATA. (See 11.8.)
Was EEPROM DATA memorized properly?
N
Y
OK
Replace the PC6 board with a new one. (See 9.4.)
Perform sensor calibration. (See 11.6.)
Perform auto-calibration of the tracking function. (See 11.11.)

## 3.2.9 “Err A” (MEMORY FAILURE ON RAM) appears.


Change the parameter setting or data, time and comments acording to the instructions in Operator’s Manual.
Turn OFF the power of the instrument and leave it for a while. Then check the set contents above.
Was EEPROM DATA memorized properly?
N
Y
Is the output voltage of the battery +3V? (See 6.4.)
N
Y
Turn ON the Power Switch to re-charge the batery.
Use the instrument for some time. If the message appears again, re-place the battery or the PC1 board. (See 9.1.)
Replace the PC1 board with a new one. (See 9.1.)

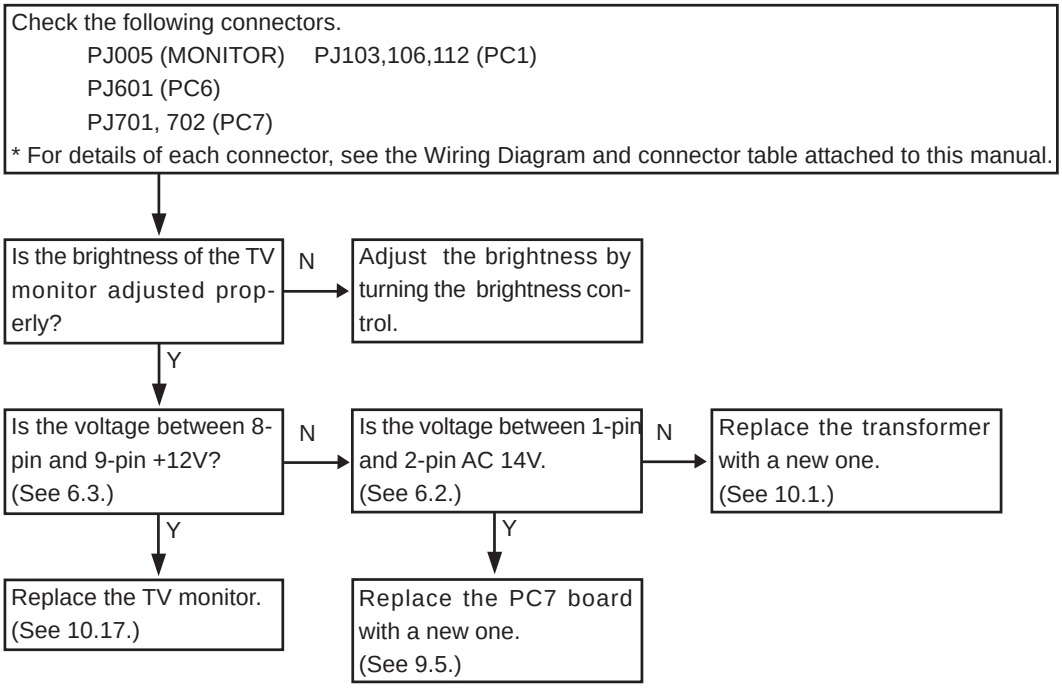
# 3.2.10 “PD ERR” appears.


Avoid using the instrument in the environment where it is exposed to the direct sunlight or an incandescent light.
If dust settles on the LED filter for PD (located at the foot of the Chin Rest), remove it with a blower brush.
Check the following connectors.
PJ105, 113 (PC1)
PJ703, 706 (PC7) PJ2301 (PC23)
* For details of each connector, refer to the Wiring Diagram or connector tabel attached to this manual.
Replace the PC23 board with a new one. (See 9.10.)
Does the symptom clear?
Y
Reform PD calibration. (See11.8.5.)
N
Replace the PC24 board with a new one. (See 9.10.)
Does the symptom clear?
Y
N
Replace the PC1 board with a new one. (See 9.1.)

# 3.3 The shutter does not open (only for AR-600 whose S/N is earlier than 10121)

Remove the shutter unit.
(See 10.8.)

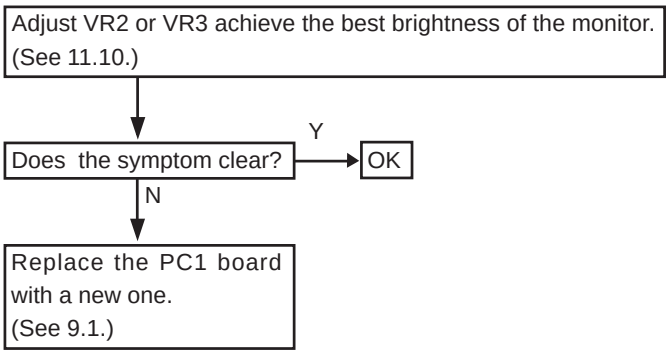
# 3.4 A raster does not appear (The TV monitor does not light well.)


Check the following connectors.
PJ005 (MONITOR) PJ103,106,112 (PC1)
PJ601 (PC6)
PJ701, 702 (PC7)
* For details of each connector, see the Wiring Diagram and connector table attached to this manual.
Is the brightness of the TV monitor adjusted properly?
N
Adjust the brightness by turning the brightness control.
Y
Is the voltage between 8-pin and 9-pin +12V? (See 6.3.)
N
Is the voltage between 1-pin and 2-pin AC 14V. (See 6.2.)
N
Replace the transformer with a new one. (See 10.1.)
Y
Y
Replace the TV monitor. (See 10.17.)
Replace the PC7 board with a new one. (See 9.5.)

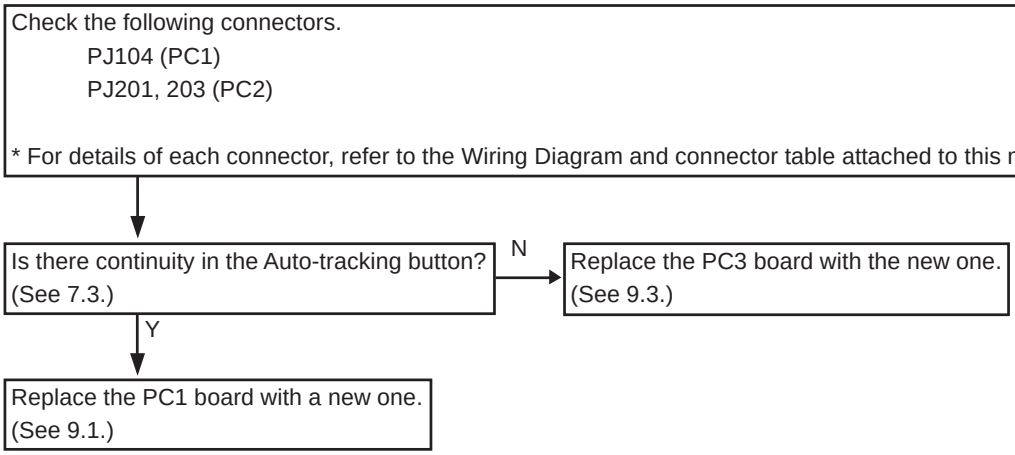
# 3.5 Eye image does not appear on the TV monitor

Replace the CCD camera unit with a new one.
(See 10.18.)

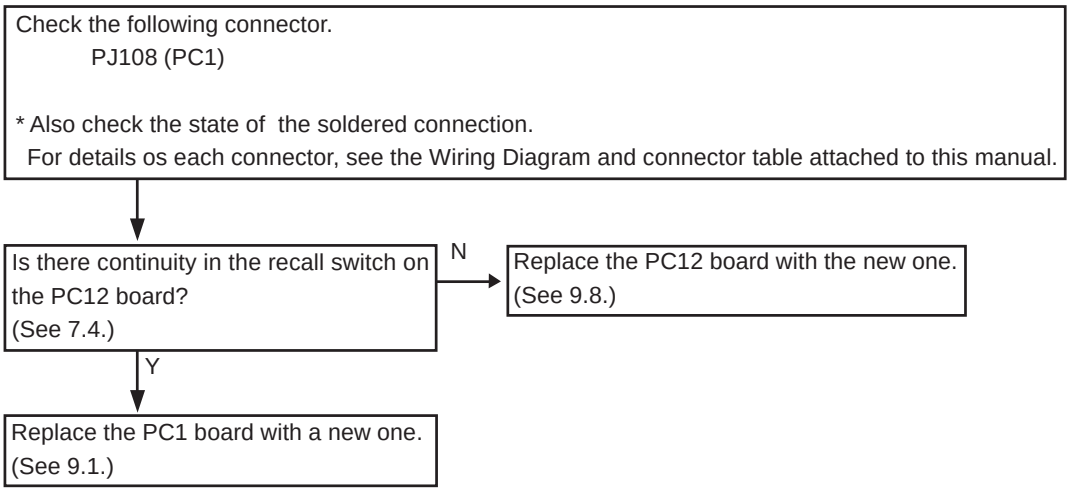
# 3.6 The characters or target are not clear or they do not appear on the TV monitor



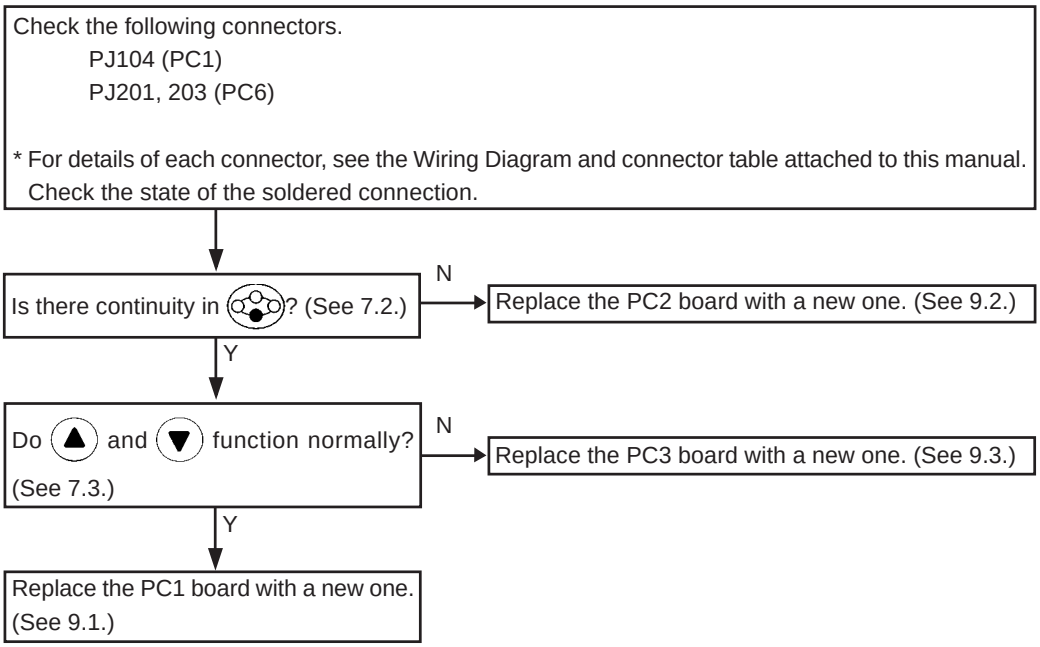

# 3.7 The switching between the manual mode and auto-tracking mode can not be done


Check the following connectors.
PJ104 (PC1)
PJ201, 203 (PC2)
* For details of each connector, refer to the Wiring Diagram and connector table attached to this manual.
Is there continuity in the Auto-tracking button?
(See 7.3.)
N
Replace the PC3 board with the new one.
(See 9.3.)
Y
Replace the PC1 board with a new one.
(See 9.1.)

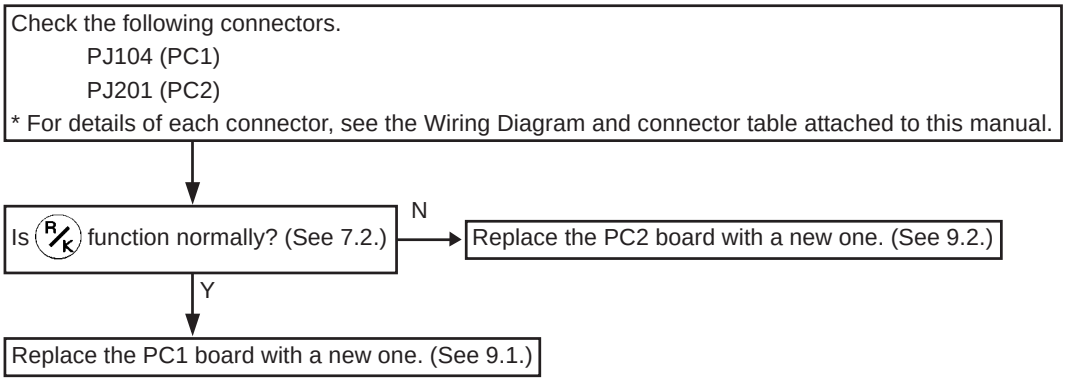
# 3.8 The instrument can not be placed into the mode where the objective measurement is performed.


Check the following connector.
PJ108 (PC1)
* Also check the state of the soldered connection.
For details os each connector, see the Wiring Diagram and connector table attached to this manual.
Is there continuity in the recall switch on the PC12 board?
(See 7.4.)
N
Replace the PC12 board with the new one.
(See 9.8.)
Y
Replace the PC1 board with a new one.
(See 9.1.)

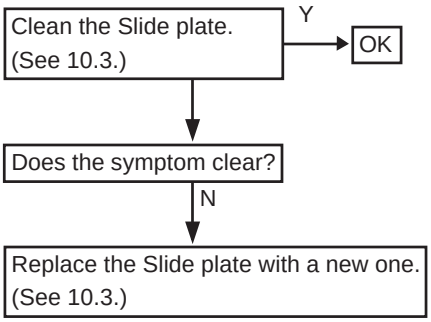
# 3.9 The parameter settings can not be changed


Check the following connectors.
PJ104 (PC1)
PJ201, 203 (PC6)
* For details of each connector, see the Wiring Diagram and connector table attached to this manual.
Check the state of the soldered connection.
Is there continuity in ? (See 7.2.)
N
Replace the PC2 board with a new one. (See 9.2.)
Y
Do and function normally?
(See 7.3.)
N
Replace the PC3 board with a new one. (See 9.3.)
Y
Replace the PC1 board with a new one.
(See 9.1.)

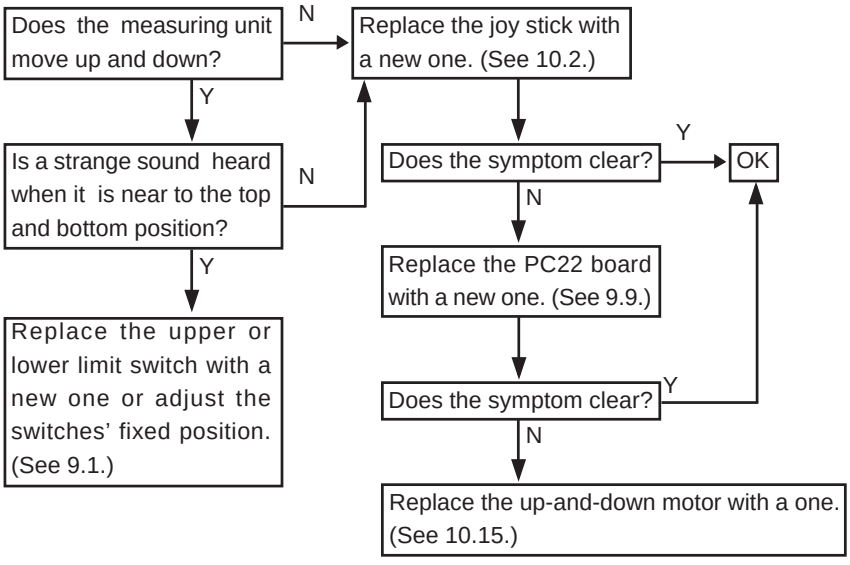
# 3.10 The measuring mode can not be changed


Check the following connectors.
PJ104 (PC1)
PJ201 (PC2)
* For details of each connector, see the Wiring Diagram and connector table attached to this manual.
Is R/K function normally? (See 7.2.)
N
Replace the PC2 board with a new one. (See 9.2.)
Y
Replace the PC1 board with a new one. (See 9.1.)

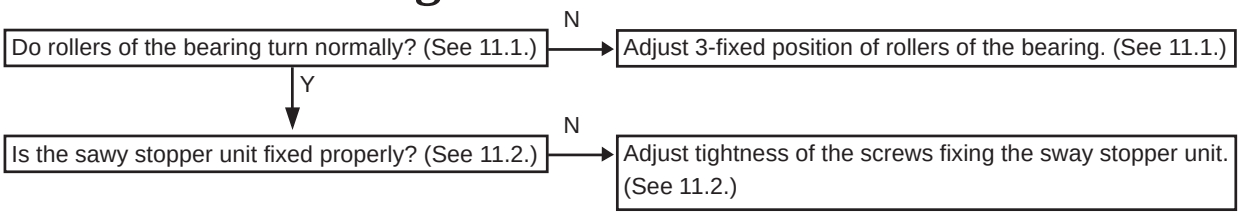
# 3.11 The movement of the measuring unit is not smooth on a plane.




# 3.12 The vertical movement of the measuring unit is not smooth

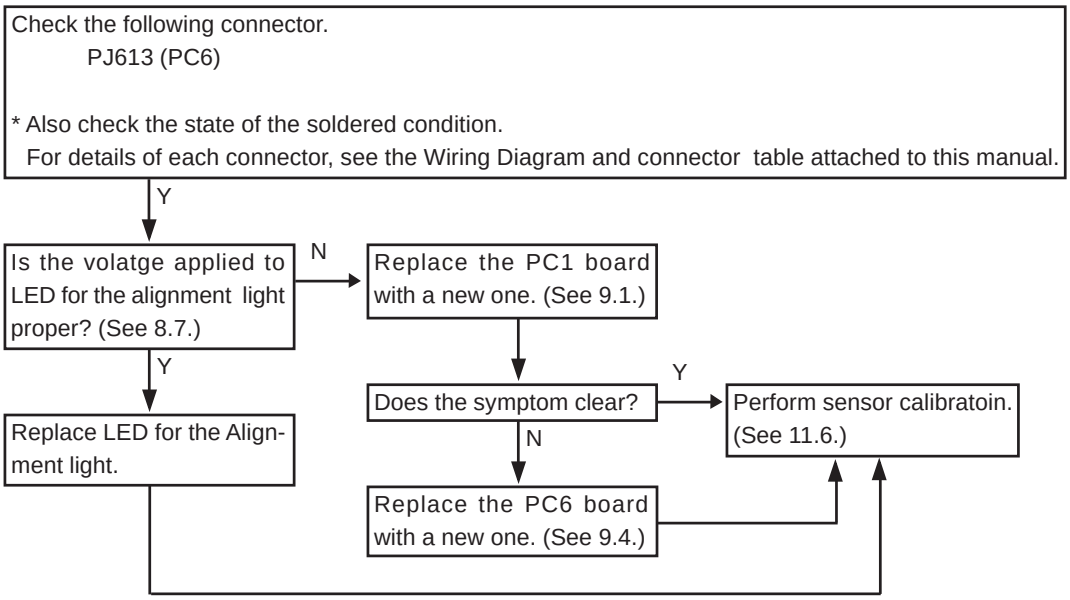

Does the measuring unit move up and down?
N
Replace the joy stick with a new one. (See 10.2.)
Y
Is a strange sound heard when it is near to the top and bottom position?
N
Y
Replace the upper or lower limit switch with a new one or adjust the switches' fixed position. (See 9.1.)
Does the symptom clear?
Y
OK
N
Replace the PC22 board with a new one. (See 9.9.)
Does the symptom clear?
Y
N
Replace the up-and-down motor with a one. (See 10.15.)

# 3.13 The measuring unit is unstable


Do rollers of the bearing turn normally? (See 11.1.)
N
Adjust 3-fixed position of rollers of the bearing. (See 11.1.)
Y
Is the sawy stopper unit fixed properly? (See 11.2.)
N
Adjust tightness of the screws fixing the sway stopper unit. (See 11.2.)

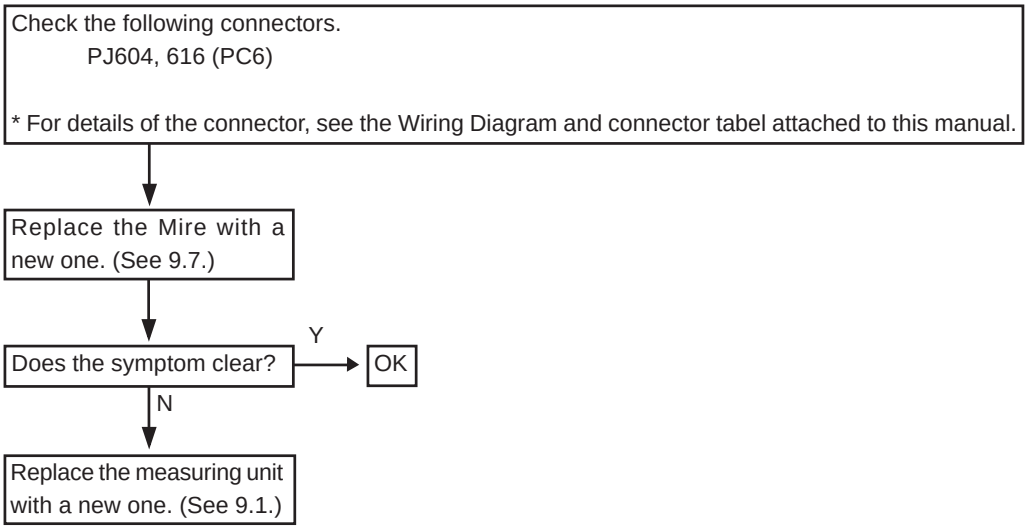
# 3.14 The alignment light does not appear

# (only for AR- 600 series)

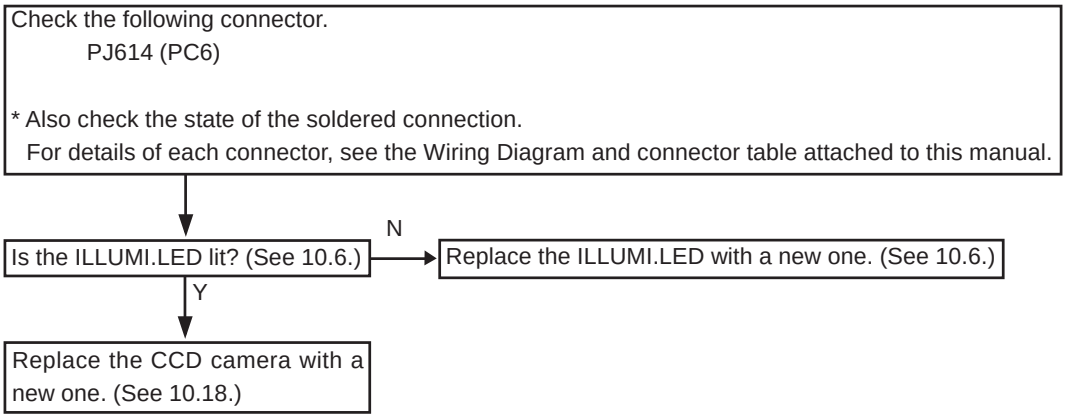

Check the following connector.
PJ613 (PC6)
* Also check the state of the soldered condition.
For details of each connector, see the Wiring Diagram and connector table attached to this manual.
Y
Is the volatge applied to LED for the alignment light proper? (See 8.7.)
N
Replace the PC1 board with a new one. (See 9.1.)
Y
Replace LED for the Alignment light.
Does the symptom clear?
Y
Perform sensor calibratoin. (See 11.6.)
N
Replace the PC6 board with a new one. (See 9.4.)

# 3.15 The Mire Ring does not appear

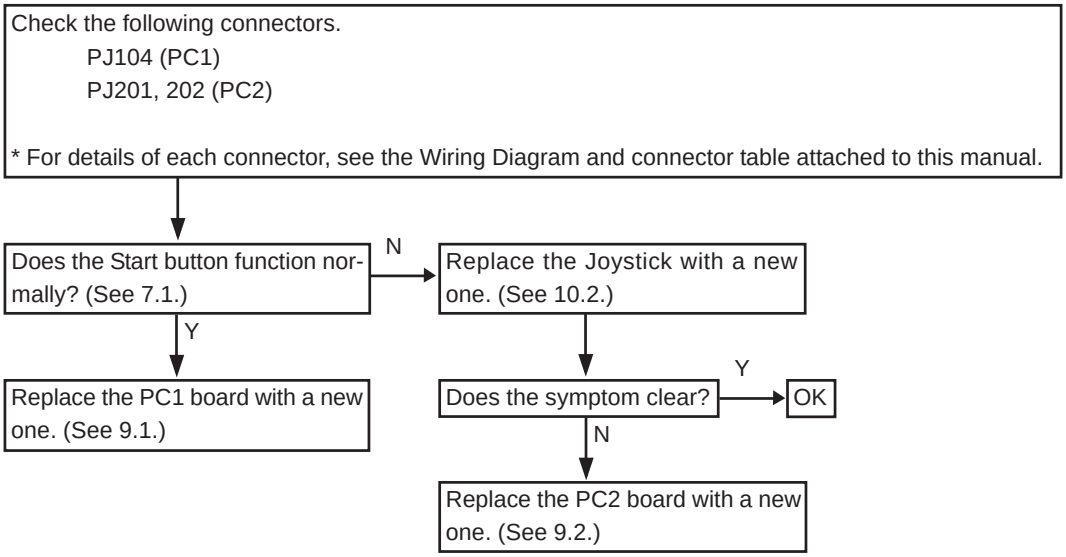
# (only for ARK-700 series)


Check the following connectors.
PJ604, 616 (PC6)
* For details of the connector, see the Wiring Diagram and connector tabel attached to this manual.
Replace the Mire with a new one. (See 9.7.)
Does the symptom clear?
Y
OK
N
Replace the measuring unit with a new one. (See 9.1.)

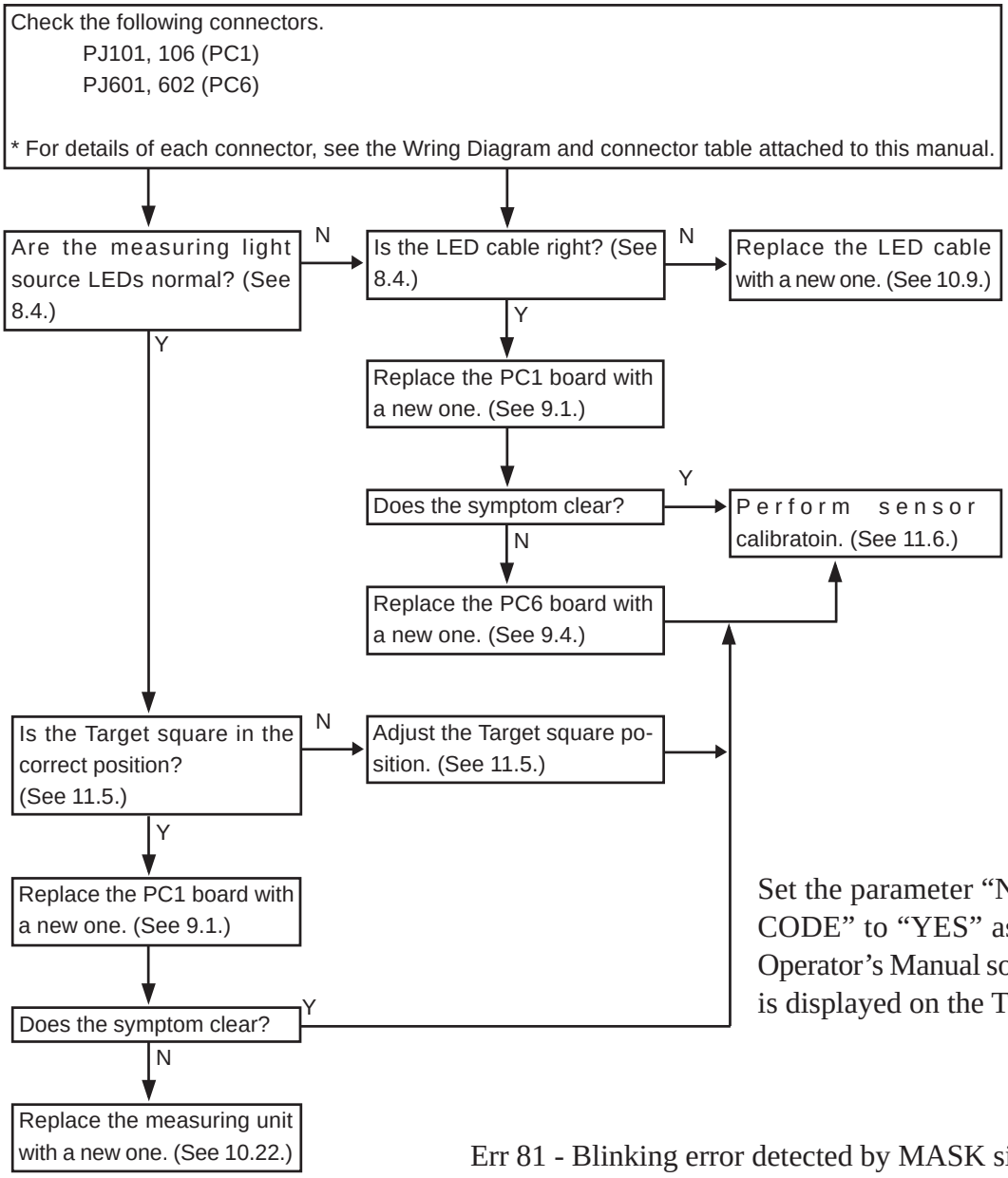
# 3.16 The model eye image is not clear


Check the following connector.
PJ614 (PC6)
* Also check the state of the soldered connection.
For details of each connector, see the Wiring Diagram and connector table attached to this manual.
Is the ILLUMI.LED lit? (See 10.6.)
N
Replace the ILLUMI.LED with a new one. (See 10.6.)
Y
Replace the CCD camera with a new one. (See 10.18.)

# 3.17 AR measurement does not start


Check the following connectors.
PJ104 (PC1)
PJ201, 202 (PC2)
* For details of each connector, see the Wiring Diagram and connector table attached to this manual.
Does the Start button function normally? (See 7.1.)
N
Replace the Joystick with a new one. (See 10.2.)
Y
Replace the PC1 board with a new one. (See 9.1.)
Does the symptom clear?
Y
OK
N
Replace the PC2 board with a new one. (See 9.2.)

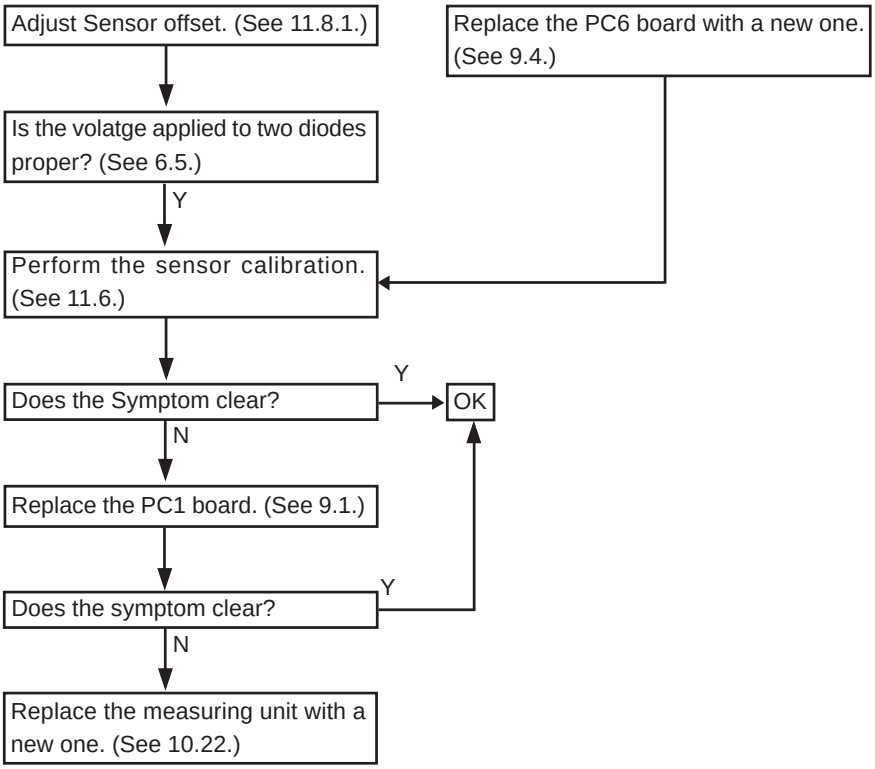
# 3.18 The message “Err” appears during AR measurements


Check the following connectors.
PJ101, 106 (PC1)
PJ601, 602 (PC6)
* For details of each connector, see the Wring Diagram and connector table attached to this manual.
Are the measuring light source LEDs normal? (See 8.4.)
N
Is the LED cable right? (See 8.4.)
N
Replace the LED cable with a new one. (See 10.9.)
Y
Y
Replace the PC1 board with a new one. (See 9.1.)
Does the symptom clear?
Y
Perform sensor calibratoin. (See 11.6.)
N
Replace the PC6 board with a new one. (See 9.4.)
Is the Target square in the correct position? (See 11.5.)
N
Adjust the Target square position. (See 11.5.)
Y
Replace the PC1 board with a new one. (See 9.1.)
Does the symptom clear?
Y
N
Replace the measuring unit with a new one. (See 10.22.)

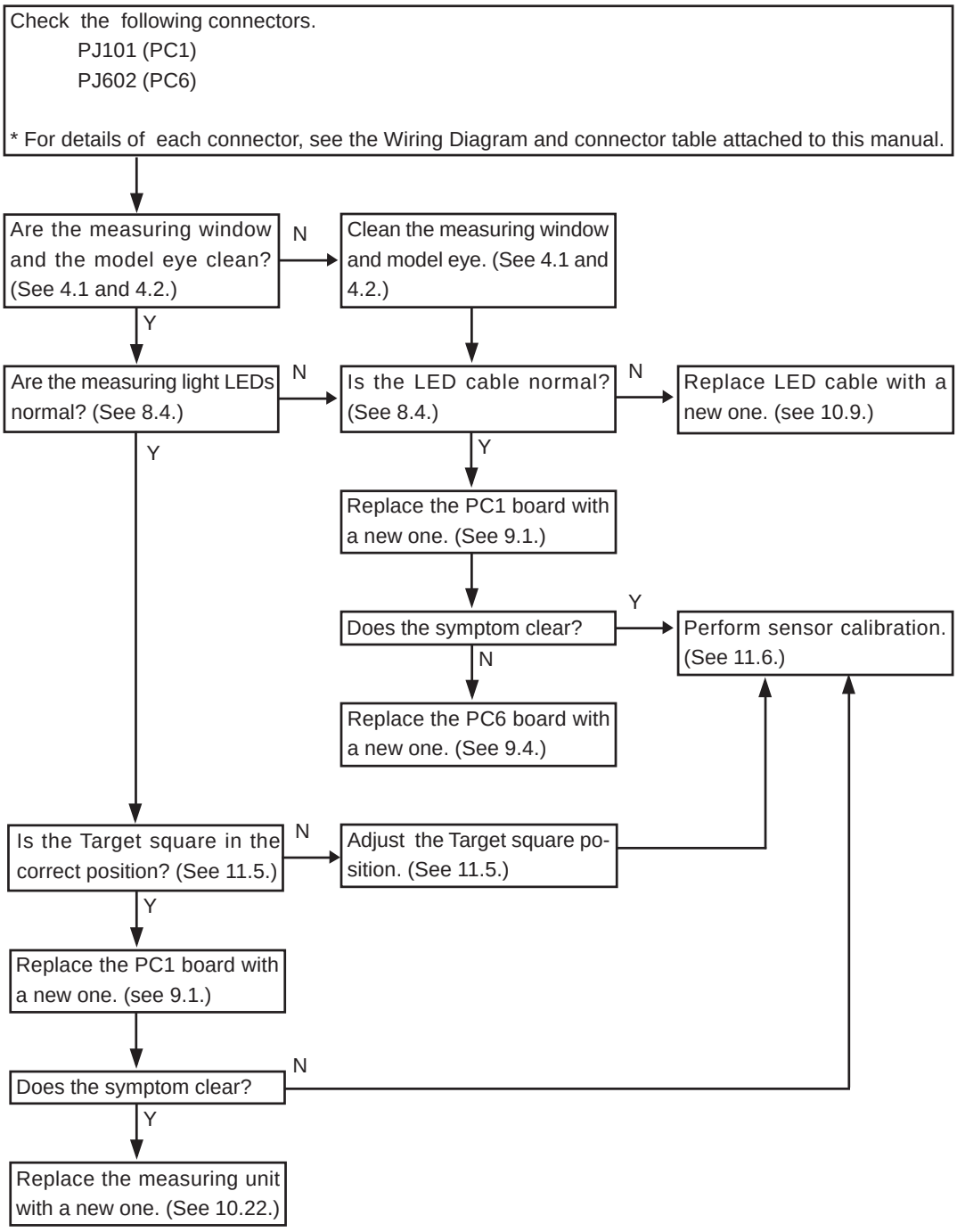
Set the parameter “No. 18 ERROR CODE” to “YES” as instructed on Operator’s Manual so that error code is displayed on the TV monitor.

Err 81 - Blinking error detected by MASK signal
Err 82 - Blinking error due to the amount of S-DIV change
Err 83 - Error due to gradient coefficient
Err 91 - SPH + over error caused when SPH value is + 23D or more (VD12mm)
Err 92 - SPH - over error caused when SPH is-18D or less (VD12mm)
Err 93 - CYL - over error caused when CYL is 8D or more (VD12mm)
Err 94 - CONF error caused by the desparity between the measuring value and the rough approximation of a sine wave.

# 3.19 Only the obtained SPH value is shifted


Adjust Sensor offset. (See 11.8.1.)
Is the volatge applied to two diodes proper? (See 6.5.)
Y
Perform the sensor calibration. (See 11.6.)
Does the Symptom clear?
Y
OK
N
Replace the PC1 board. (See 9.1.)
Does the symptom clear?
Y
N
Replace the measuring unit with a new one. (See 10.22.)
Replace the PC6 board with a new one. (See 9.4.)

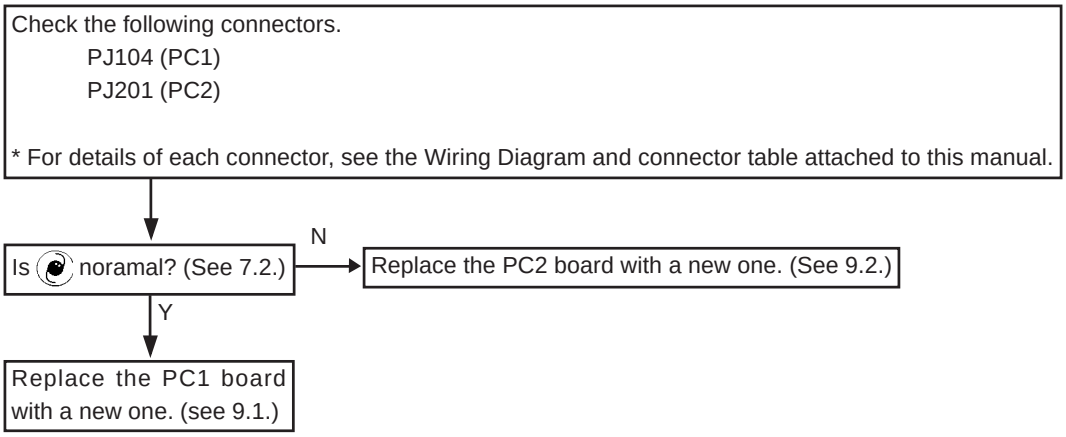
# 3.20 The obtained CYL value is too large


Check the following connectors.
PJ101 (PC1)
PJ602 (PC6)
* For details of each connector, see the Wiring Diagram and connector table attached to this manual.
Are the measuring window and the model eye clean? (See 4.1 and 4.2.)
N
Clean the measuring window and model eye. (See 4.1 and 4.2.)
Y
Are the measuring light LEDs normal? (See 8.4.)
N
Is the LED cable normal? (See 8.4.)
N
Replace LED cable with a new one. (see 10.9.)
Y
Y
Replace the PC1 board with a new one. (See 9.1.)
Does the symptom clear?
Y
Perform sensor calibration. (See 11.6.)
N
Replace the PC6 board with a new one. (See 9.4.)
Is the Target square in the correct position? (See 11.5.)
N
Adjust the Target square position. (See 11.5.)
Y
Replace the PC1 board with a new one. (see 9.1.)
Does the symptom clear?
N
Y
Replace the measuring unit with a new one. (See 10.22.)

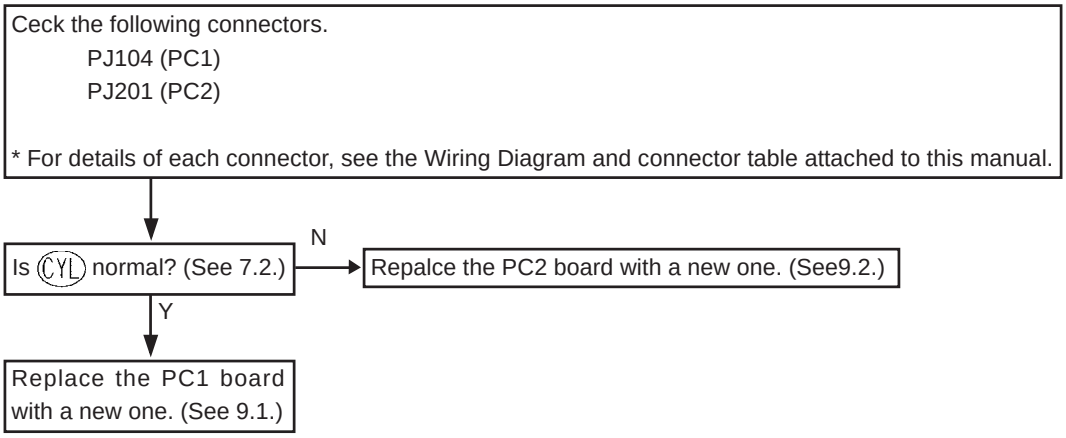
# 3.21 A short beep can not be heard when pressing the Start button

Replace the PC1 board with a new one.
(see 9.1.)

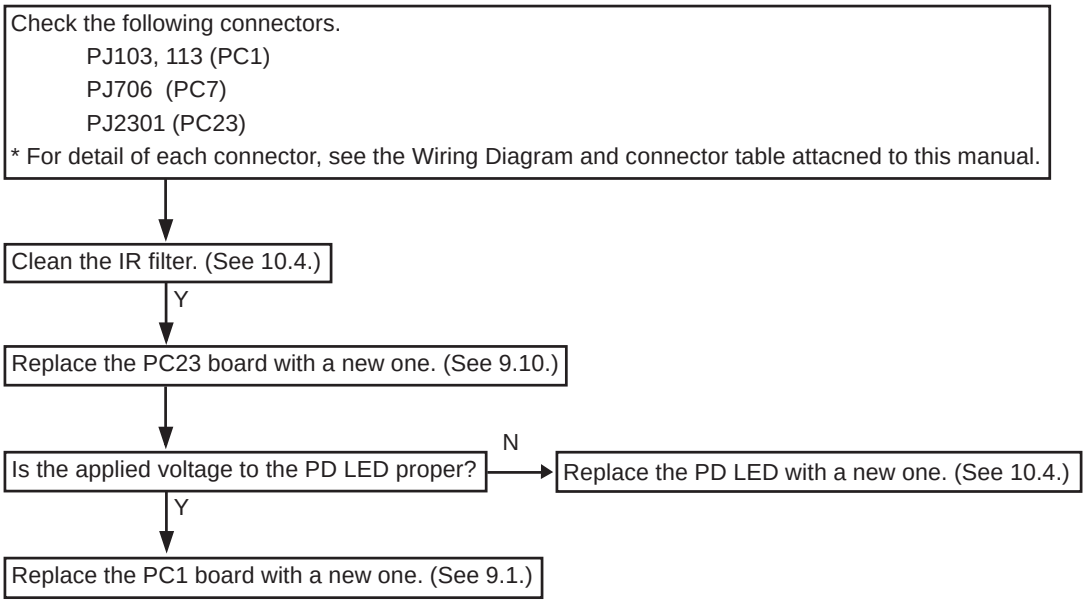
# 3.22 The IOL mode can not be turned ON


Check the following connectors.
PJ104 (PC1)
PJ201 (PC2)
* For details of each connector, see the Wiring Diagram and connector table attached to this manual.
Is noramal? (See 7.2.)
N
Replace the PC2 board with a new one. (See 9.2.)
Y
Replace the PC1 board with a new one. (see 9.1.)

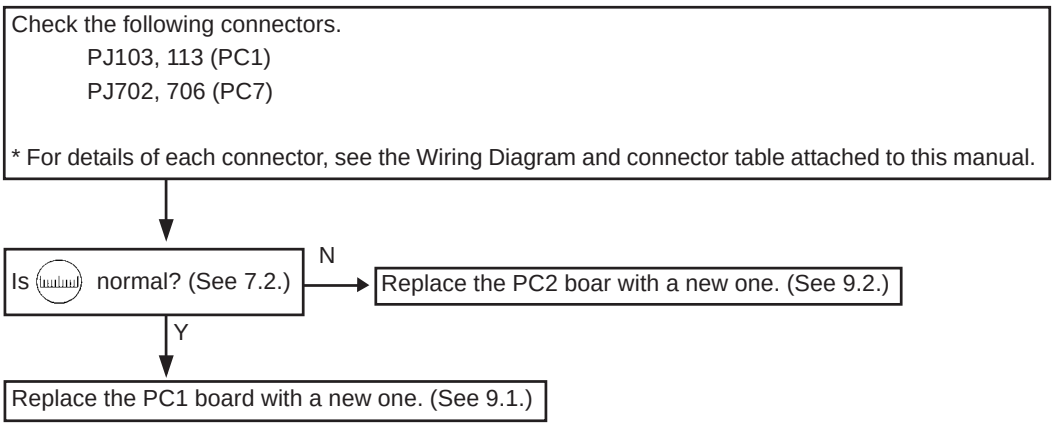
# 3.23 The Cylinder mode can not be changed


Ceck the following connectors.
PJ104 (PC1)
PJ201 (PC2)
* For details of each connector, see the Wiring Diagram and connector table attached to this manual.
Is CYL normal? (See 7.2.)
N
Repalce the PC2 board with a new one. (See9.2.)
Y
Replace the PC1 board with a new one. (See 9.1.)

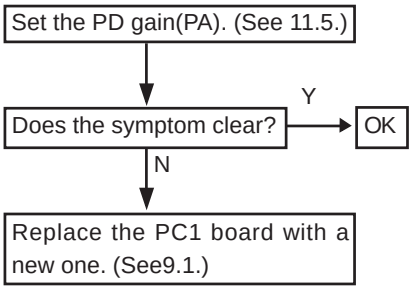
# 3.24 The instrument can not recognize the left and right


Check the following connectors.
PJ103, 113 (PC1)
PJ706 (PC7)
PJ2301 (PC23)
* For detail of each connector, see the Wiring Diagram and connector table attacned to this manual.
Clean the IR filter. (See 10.4.)
Y
Replace the PC23 board with a new one. (See 9.10.)
Is the applied voltage to the PD LED proper?
N
Replace the PD LED with a new one. (See 10.4.)
Y
Replace the PC1 board with a new one. (See 9.1.)

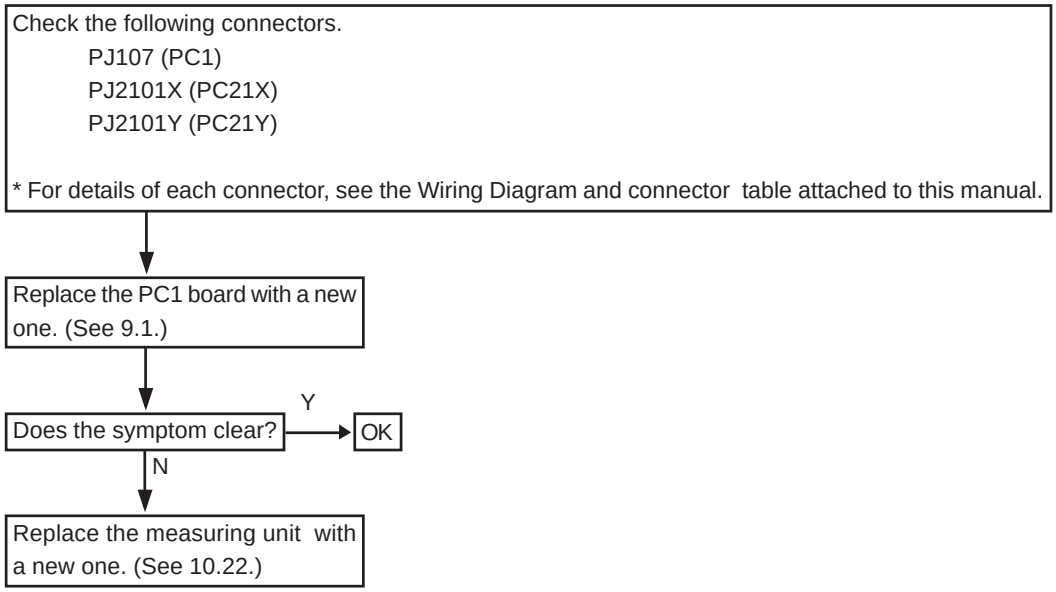
# 3.25 The instrument can not be placed in the PD mode


Check the following connectors.
PJ103, 113 (PC1)
PJ702, 706 (PC7)
* For details of each connector, see the Wiring Diagram and connector table attached to this manual.
Is normal? (See 7.2.)
N
Replace the PC2 boar with a new one. (See 9.2.)
Y
Replace the PC1 board with a new one. (See 9.1.)

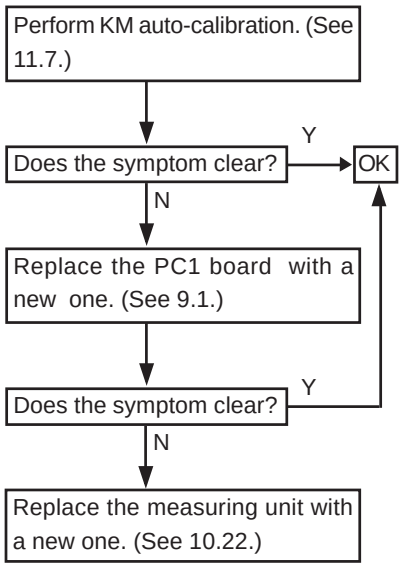
# 3.26 The obtained PD value is abnormal




# 3.27 The message “Err” appears during KM measurement


Check the following connectors.
PJ107 (PC1)
PJ2101X (PC21X)
PJ2101Y (PC21Y)
* For details of each connector, see the Wiring Diagram and connector table attached to this manual.
Replace the PC1 board with a new one. (See 9.1.)
Does the symptom clear?
Y
OK
N
Replace the measuring unit with a new one. (See 10.22.)

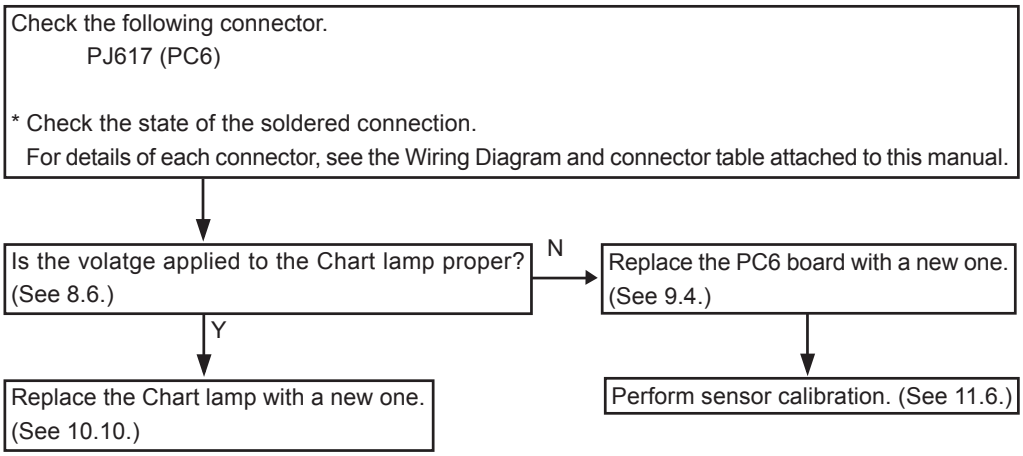
# 3.28 The obtained KM value is abnormal



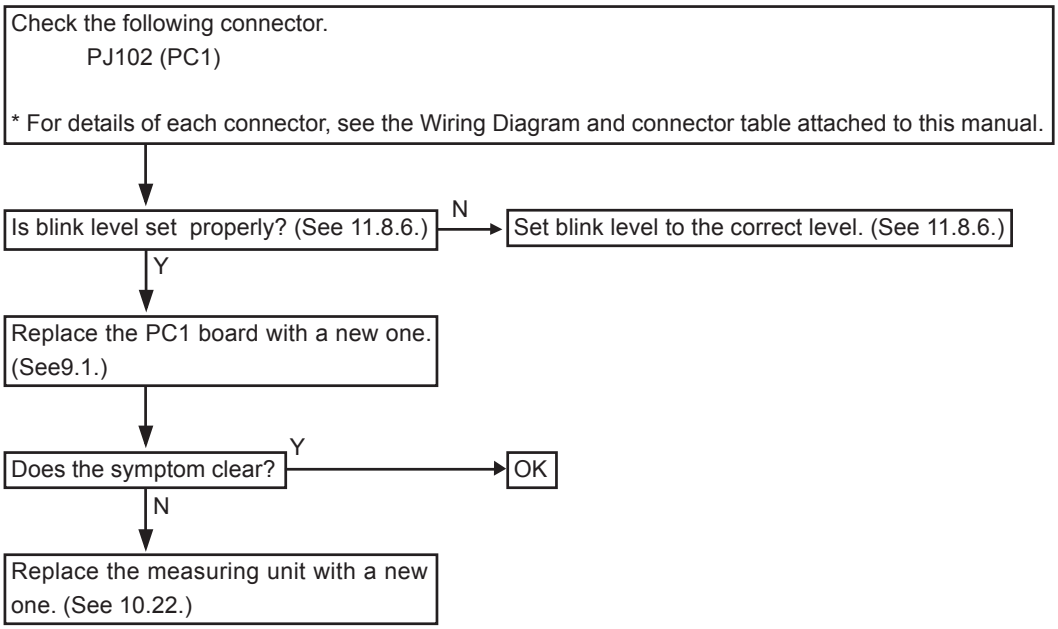
# 3.29 The up-and-down movement of the Chin rest is not smooth

Adjust the up-and-down movement of the Chin rest.
(See11.3.)

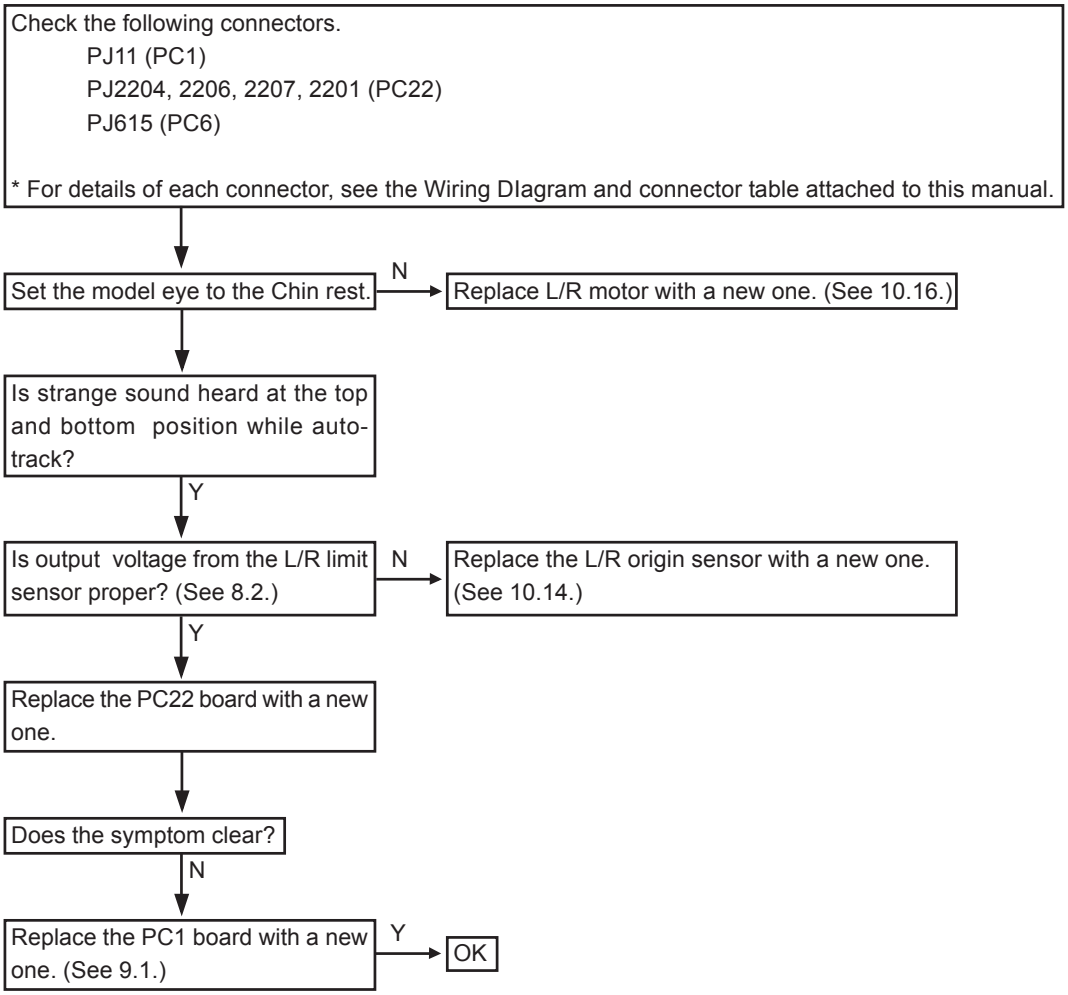
# 3.30 The chart can not be seen


Check the following connector.
PJ617 (PC6)
* Check the state of the soldered connection.
For details of each connector, see the Wiring Diagram and connector table attached to this manual.
Is the volatge applied to the Chart lamp proper?
(See 8.6.)
N
Replace the PC6 board with a new one.
(See 9.4.)
Y
Replace the Chart lamp with a new one.
(See 10.10.)
Perform sensor calibration. (See 11.6.)

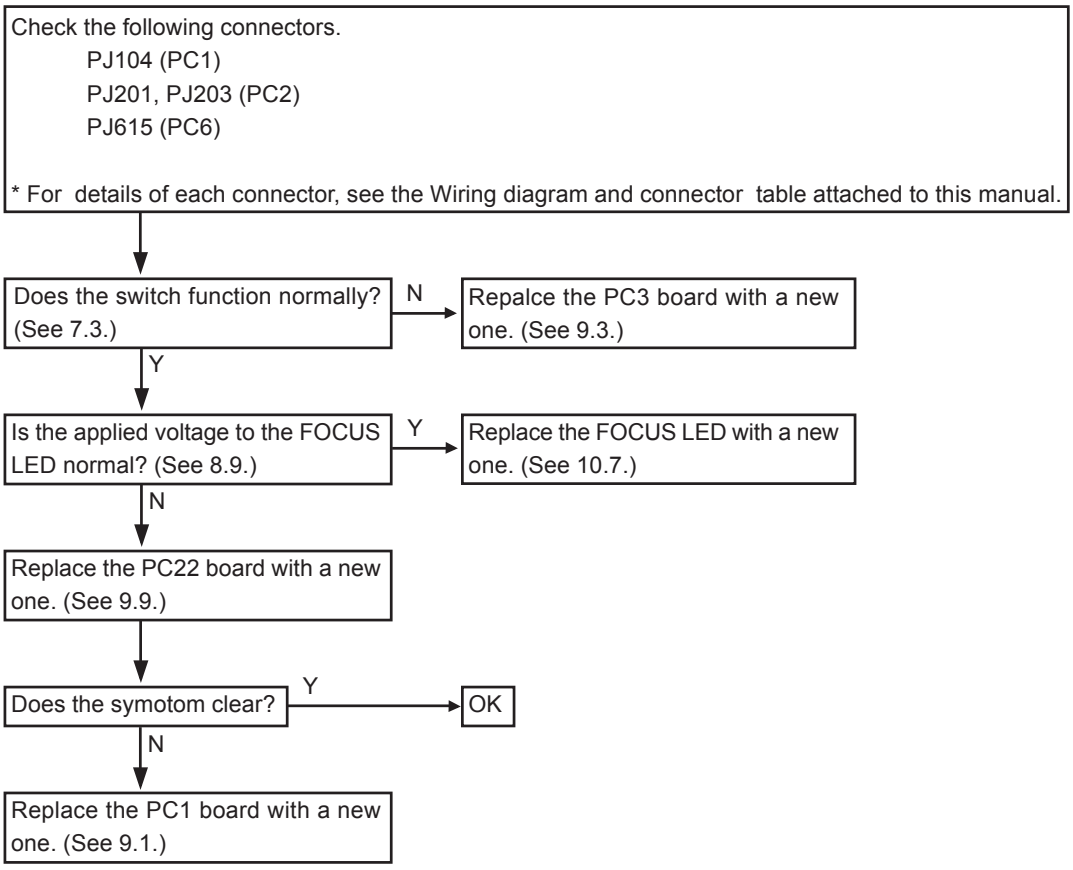
# 3.31 “Err” does not appear though the patient blinked during measurement


Check the following connector.
PJ102 (PC1)
* For details of each connector, see the Wiring Diagram and connector table attached to this manual.
Is blink level set properly? (See 11.8.6.)
N
Set blink level to the correct level. (See 11.8.6.)
Y
Replace the PC1 board with a new one. (See9.1.)
Does the symptom clear?
Y
OK
N
Replace the measuring unit with a new one. (See 10.22.)

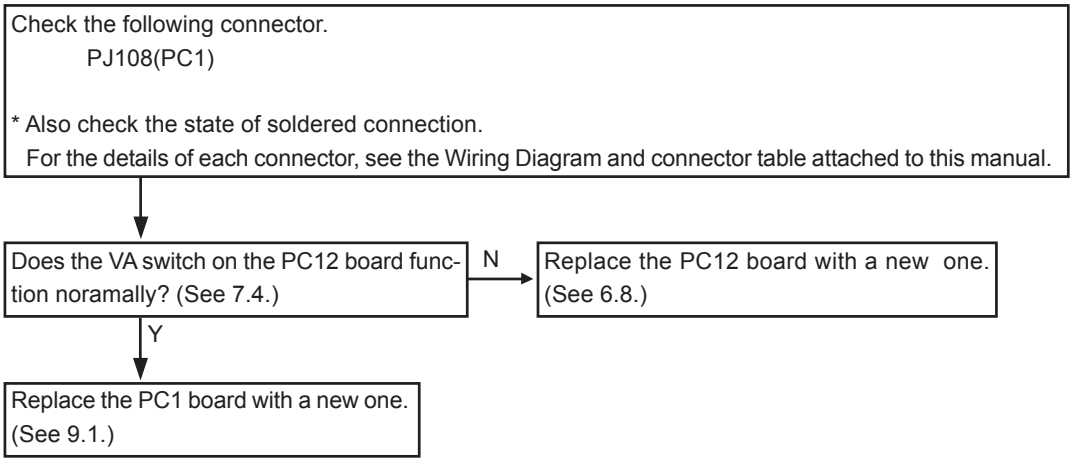
# 3.32 The auto-tracking function does not work


Check the following connectors.
PJ11 (PC1)
PJ2204, 2206, 2207, 2201 (PC22)
PJ615 (PC6)
* For details of each connector, see the Wiring DIagram and connector table attached to this manual.
Set the model eye to the Chin rest.
N
Replace L/R motor with a new one. (See 10.16.)
Is strange sound heard at the top and bottom position while auto-track?
Y
Is output voltage from the L/R limit sensor proper? (See 8.2.)
N
Replace the L/R origin sensor with a new one. (See 10.14.)
Y
Replace the PC22 board with a new one.
Does the symptom clear?
N
Replace the PC1 board with a new one. (See 9.1.)
Y
OK

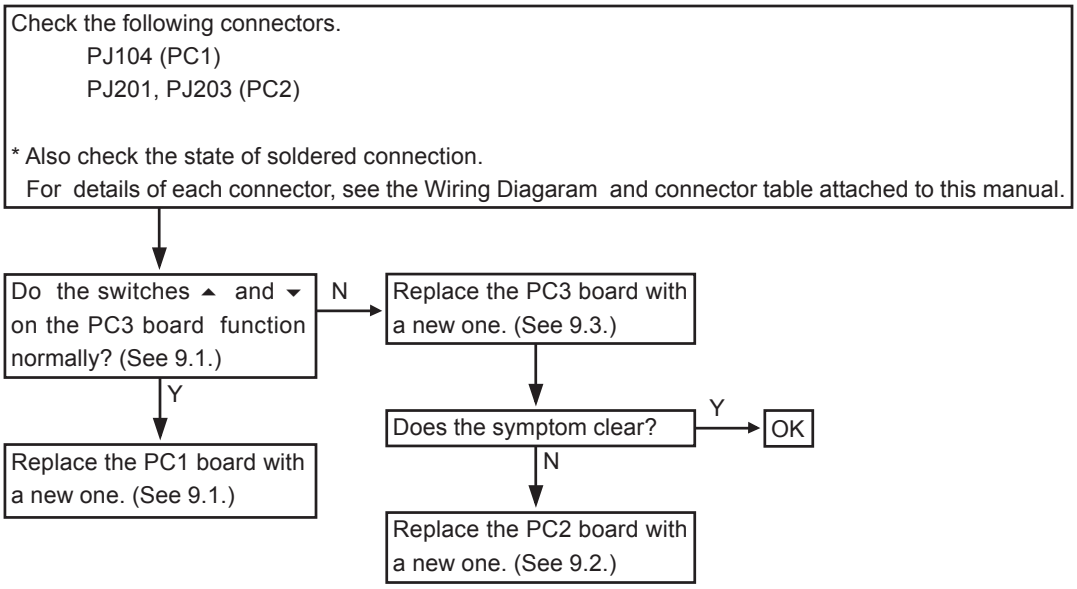
# 3.33 The auto-shot function does not work


Check the following connectors.
PJ104 (PC1)
PJ201, PJ203 (PC2)
PJ615 (PC6)
* For details of each connector, see the Wiring diagram and connector table attached to this manual.
Does the switch function normally? (See 7.3.)
N
Repalce the PC3 board with a new one. (See 9.3.)
Y
Is the applied voltage to the FOCUS LED normal? (See 8.9.)
Y
Replace the FOCUS LED with a new one. (See 10.7.)
N
Replace the PC22 board with a new one. (See 9.9.)
Does the symotom clear?
Y
OK
N
Replace the PC1 board with a new one. (See 9.1.)

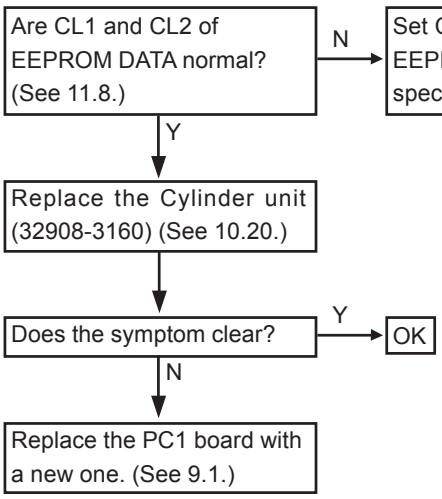
# 3.34 The instrument can not be placed in the VA TEST mode


Check the following connector.
PJ108(PC1)
* Also check the state of soldered connection.
For the details of each connector, see the Wiring Diagram and connector table attached to this manual.
Does the VA switch on the PC12 board function noramally? (See 7.4.)
N
Replace the PC12 board with a new one. (See 6.8.)
Y
Replace the PC1 board with a new one. (See 9.1.)

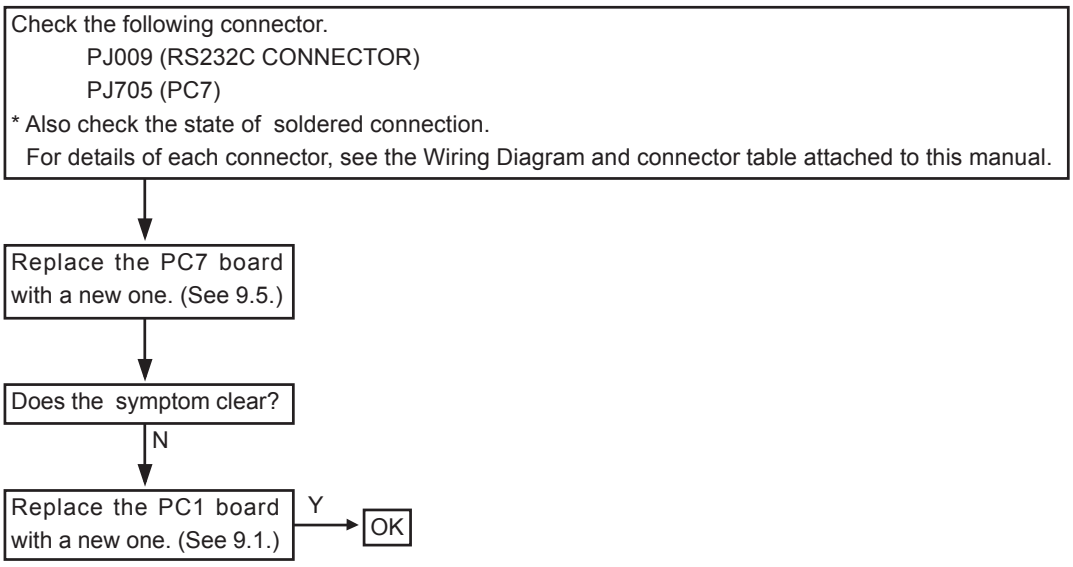
# 3.35 VA Charts can not be changed


Check the following connectors.
PJ104 (PC1)
PJ201, PJ203 (PC2)
* Also check the state of soldered connection.
For details of each connector, see the Wiring Diagaram and connector table attached to this manual.
Do the switches ▲ and ▼ on the PC3 board function normally? (See 9.1.)
N
Replace the PC3 board with a new one. (See 9.3.)
Y
Replace the PC1 board with a new one. (See 9.1.)
Does the symptom clear?
Y
OK
N
Replace the PC2 board with a new one. (See 9.2.)

# 3.36 The presented chart is out of focus during the subjective measurement (except when a patient has irregular astigmatism)


Are CL1 and CL2 of EEPROM DATA normal? (See 11.8.)
N
Set CL1 and CL2 of EEPROM DATA to their specified values. (See 11.8.)
Y
Replace the Cylinder unit (32908-3160) (See 10.20.)
Does the symptom clear?
Y
OK
N
Replace the PC1 board with a new one. (See 9.1.)

# 3.37 The message “Err IF” (Interface Error) appears


Check the following connector.
PJ009 (RS232C CONNECTOR)
PJ705 (PC7)
* Also check the state of soldered connection.
For details of each connector, see the Wiring Diagram and connector table attached to this manual.
Replace the PC7 board with a new one. (See 9.5.)
Does the symptom clear?
N
Replace the PC1 board with a new one. (See 9.1.)
Y
OK

NOTE)
If the error message “Err IF” appears, set the parameter “ERROR CODE” to “YES” as instructed on Operator’s Manual so that the particular error code will appear to indicate the corresponding error state. The following describes ten error codes and the corresponding contents. It will be helpful when searching for errors.

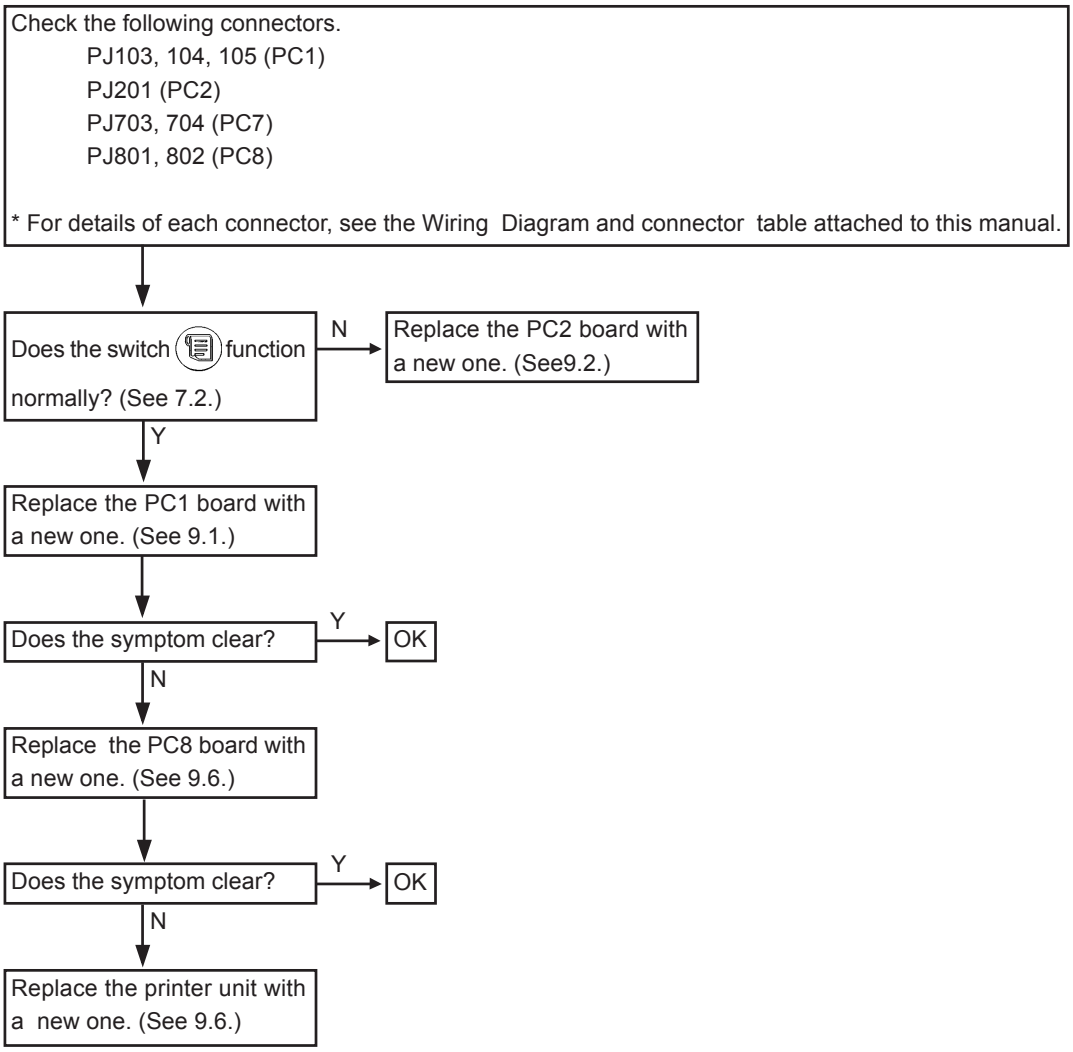
I/F CONNECTOR communication error

Err 11- DSR is flagged when SD command is received.
Err 12 - DSR is flagged when data is transmitted.
Err 13 - No input data comes
Err 14 - The reception buffer is full.
Err 15 - Illegible commands are received.

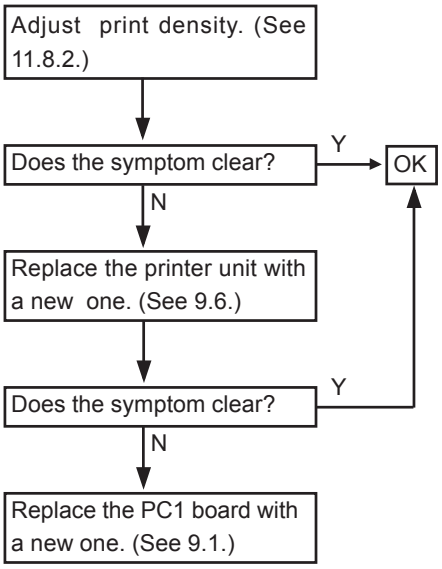
IC CARD R/W communication error

Err 18- DSR is flagged when SD command is received.
Err 19 - DSR is flagged when data is transmitted.
Err 20 - No input data comes
Err 21 - The reception buffer is full.
Err 22 - Illegible commands are received.

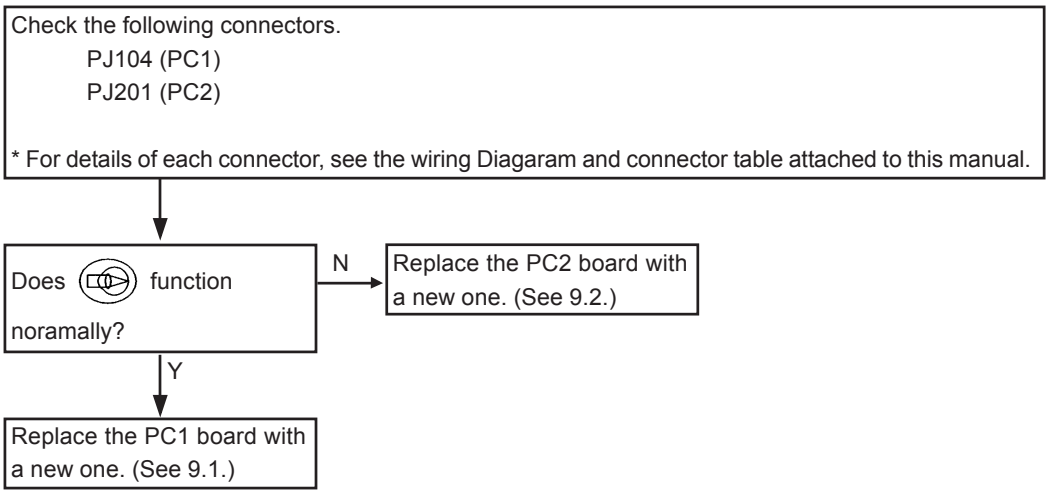
# 3.38 The printer does not operate


Check the following connectors.
PJ103, 104, 105 (PC1)
PJ201 (PC2)
PJ703, 704 (PC7)
PJ801, 802 (PC8)
* For details of each connector, see the Wiring Diagram and connector table attached to this manual.
Does the switch function normally? (See 7.2.)
N
Replace the PC2 board with a new one. (See9.2.)
Y
Replace the PC1 board with a new one. (See 9.1.)
Does the symptom clear?
Y
OK
N
Replace the PC8 board with a new one. (See 9.6.)
Does the symptom clear?
Y
OK
N
Replace the printer unit with a new one. (See 9.6.)

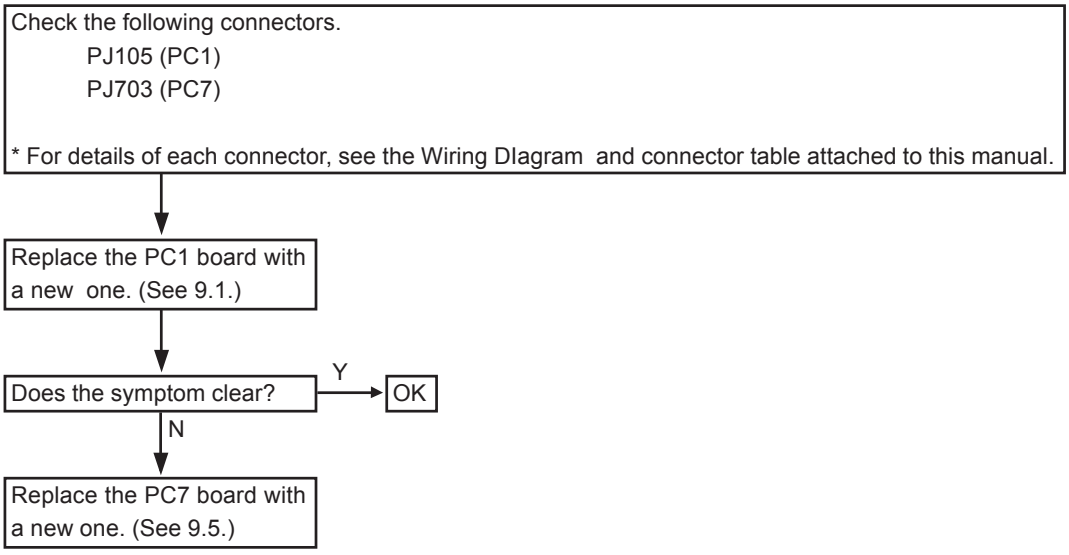
# 3.39 Light printed text/loss of text



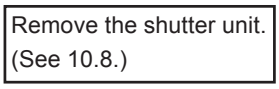
# 3.40 The Eyeprint function can not be turned on


Check the following connectors.
PJ104 (PC1)
PJ201 (PC2)
* For details of each connector, see the wiring Diagaram and connector table attached to this manual.
Does function noramally?
N
Replace the PC2 board with a new one. (See 9.2.)
Y
Replace the PC1 board with a new one. (See 9.1.)

# 3.41 The TV auto-OFF function does not work


Check the following connectors.
PJ105 (PC1)
PJ703 (PC7)
* For details of each connector, see the Wiring DIagram and connector table attached to this manual.
Replace the PC1 board with a new one. (See 9.1.)
Does the symptom clear?
Y
OK
N
Replace the PC7 board with a new one. (See 9.5.)

# 3.42 The shutter does not close (only for the AR-600 whose S/N is earlier than 10121)



# §4 Checking the obtained data with Model eyes

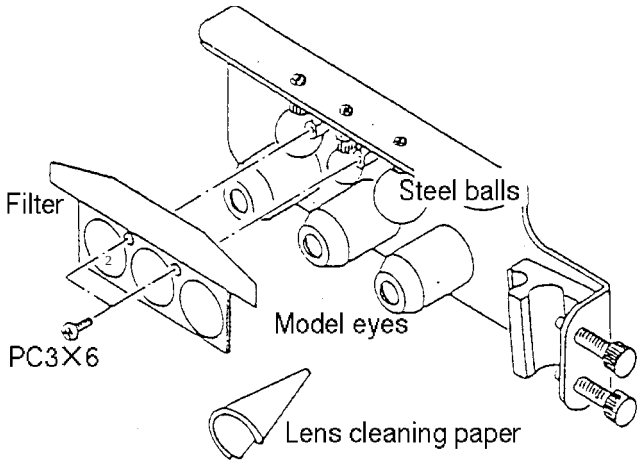
Obtaining the measurements with the model eyes ( ＋ 10D, 0D and － 10D) and the Steel balls (5.95mm, 7.94mm and 9.13mm) is important for checking if the instrument operates normally or not. The service persons should be trained to obtain the reliable data correctly. If they adjusts the electrical, optical, or mechanical parts of the instrument according to the incorrect data, the instrument may be out of working order.
The following describes the notes and procedures for obtaining the correct data with Model eyes and Steel balls.

## 4.1 Cleaning the Model eyes and Steel balls

1. **Remove the filter.**

2. **Blow out dust with a blower.**

3. **Fold lens cleaning paper with acetone as shown in the right figure. Wipe the model eyes and steel balls with it.**



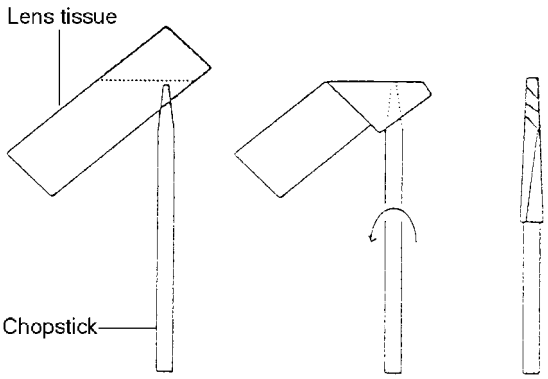

4. **Check to see that the model eyes and steel balls are clean. If not replace the paper with a new one and repeat the cleaning.**

# 4.2 Cleaning the measuring window

1. **Turn ON the Power switch to open the shutter (only for the early model AR-600).**

2. **Blow out dust with a blower.**

3. **Wrap lens tissue (Japanese special paper : Ganpi-shi) around the tool (for example, chopstick) as shown in the figure. Then dip it into acetone and wipe the measuring window with it.**



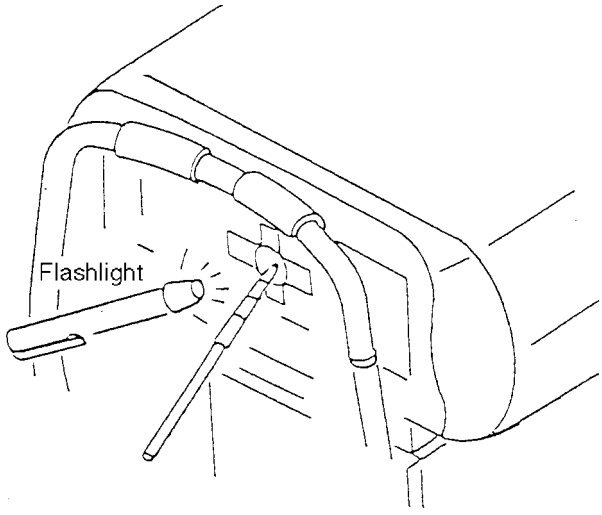

   * Pay attention not to dip it into too much acetone. Otherwise, acetone remains on the measuring window.

   For lens tissue, use Japanese special paper : Ganpi-shi.
   For the Chopstick, use the sticks which are unlikely to scratch glass.

   * Wipe the window as if drawing a circle from the center to the outside.

4. **Check to see that the measuring window is clean by using a flashlight. If not, replace the tissue with a new one and repeat the cleaning.**

   * If acetone deposits the covers of the instrument, it may result in decoloration. Pay attention not to spot the covers with acetone. If the cover changes in color, replace it with a new one.



# 4.3 Measuring the Model eyes

1. **Attach the Model eyes (ARKJ-4) to the Forehead rest.**
   * Do not tighten the screws too much. The Forehead rest may be scratched.

2. **Turn the Power switch ON.**

3. **Set the parameter 1: STEP to 0.01D.**

4. **Perform alignment and focusing correctly as instructed on Operator's Manual, and start measurement.**

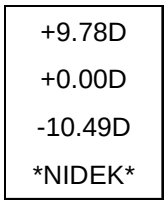
   * In case of measuring the Model eye of 10D, the range that you detect focusing is within ± 1.0D. This can cause an error in measurement.
   Therefore, every time, move the Joystick to the same direction in order to perform a precise alignment.

# 4.4 Tolerance on AR measurement error

See the table on the right.

* The labels on the Model eyes tell SPH power of each eye.
Compare the obtained SPH with the correct SPH stuck to the Model eyes and check if the error is within tolerance.

| | TOLERANCE | |
|---|---|---|
| | SPHERE | CYLINDER |
| +10D | ±0.25D | ±0.25D |
| 0D | ±0.25D | ±0.25D |
| -10D | ±0.25D | ±0.25D |



# 4.5 Measuring the Steel balls

1. **Attach the Model eye (ARKJ-4) to the Forehead rest.**

2. **Turn the Power switch ON.**
   Pressing R/K , the instrument will be placed in the <K> (KM measurement) mode.

3. **Perform fine alignment and focusing and start measurement.**

   * When measuring the steel balls, the range that you detect focusing is ±0.1D. This can cause an error in measurement. Therefore, every time, move Joystick to the same direction in order to perform a precise alignment.

# 4.6 Tolerance on KM measurement error

See the table on the right.

| | TOLERANCE | |
|---|---|---|
| | AVE | R1-R2 |
| R5.95 | ±0.02 | ±0.04 |
| R7.94 | ±0.02 | ±0.04 |
| R9.13 | ±0.02 | ±0.04 |

# §5 Removing covers

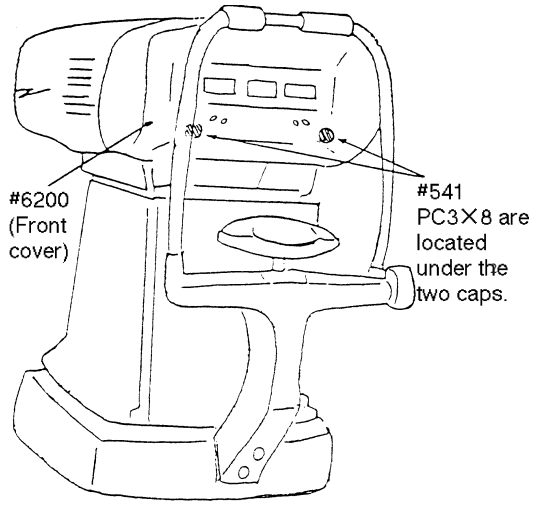
## 5.1 Removing the Front, Left and Right covers

**1. Remove two caps (#541) on the front cover.**

Remove them with a screwdriver so as not to scratch the caps.

**2. Unscrew PC3 × 8 (n=2).**

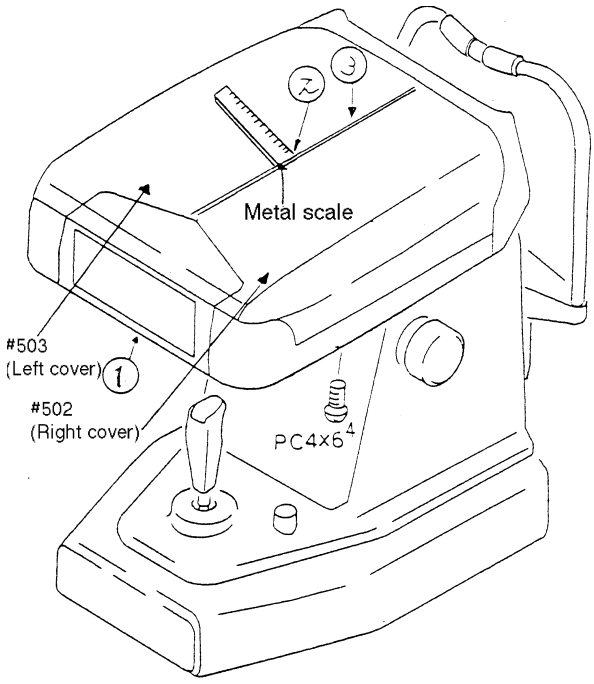
* It is not possible to remove the Front cover yet.

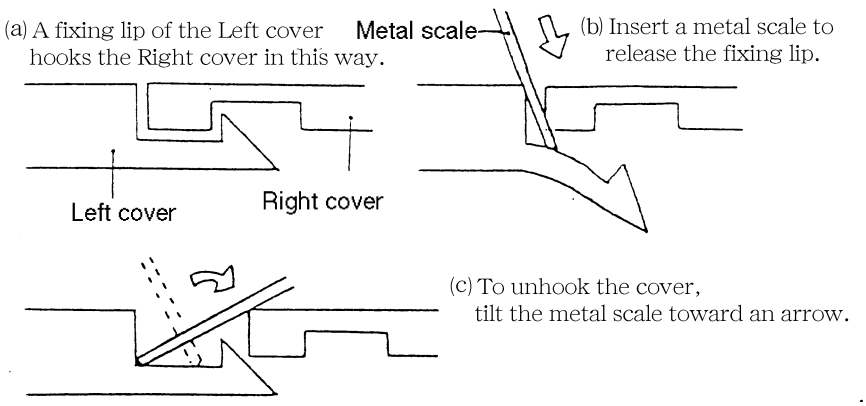


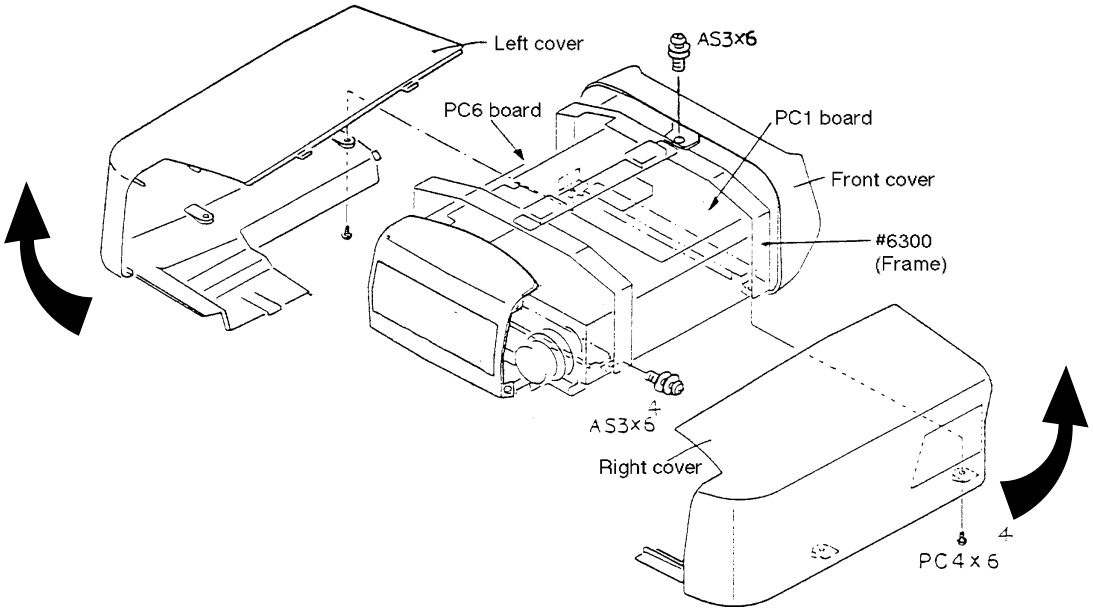

**3. Unscrew PC4 × 6 (n=4) fixing the Left and Right covers at the bottom of them.**

**4. Insert a metal scale or an equivalent in a clearance between the left and right covers and release the fixing lip to remove the covers.**

* The left and right covers are combined with three fixing lips ①,② and ③ as shown in the figure.





(a) A fixing lip of the Left cover hooks the Right cover in this way.
Metal scale
(b) Insert a metal scale to release the fixing lip.
Left cover
Right cover
(c) To unhook the cover, tilt the metal scale toward an arrow.




5. **Remove the Left and Right covers.**
   * When removing or assembling the Left and right covers, hold both the covers with your both right and left hands and open them to the arrow direction as above.
   When fitting the cover, fasten the fixing lips of the Front cover in advance.

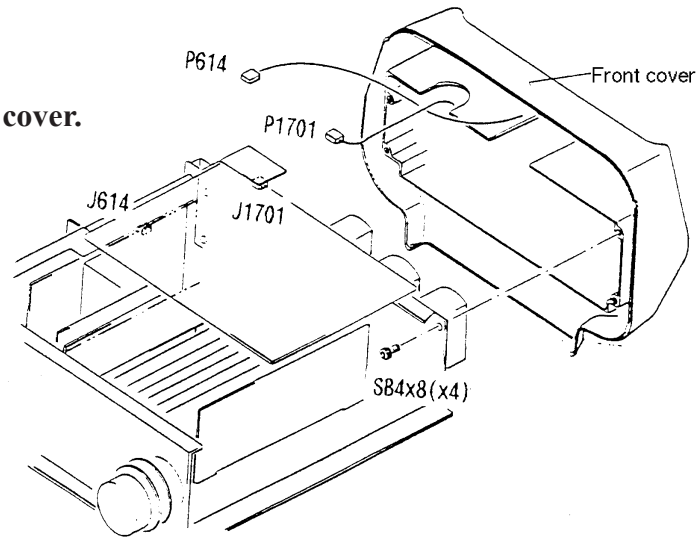
6. **Unscrew AS3 × 6 fixing the front cover.**

7. **Unscrew AS3 × 6 (n=4) fixing the frame to remove the frame #6300.**

8. **Disconnect J13 (flat cable) on the PC1 board, J19 (white, black) and J14 (red, black) on the PC6 board from connectors.**

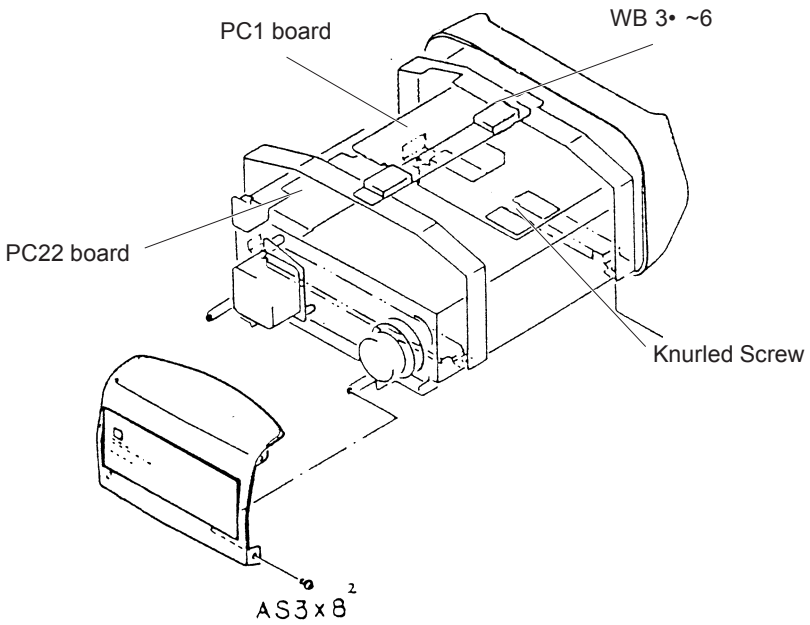
9. **Release the mask cable (gray flat cable) and alignment LED cable (orange, black) from the metal clamps on front cover.**
   * When fitting the Front cover, these cables should be located as before.
   It is necessary to remember their original position.

10. **Remove the front cover.**



# 5.2 Removing the Rear cover of the measuring unit

1. **Unscrew AS3 × 8 (n=2) to remove the Rear cover.**

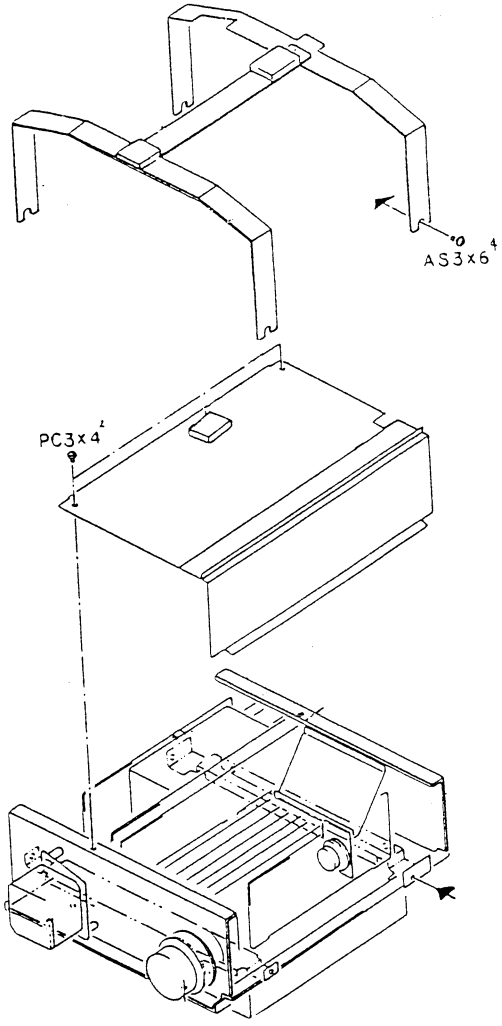



# 5.3 Removing the Inner cover

1. **Loosen AS3 × 8 (n=4) to remove the frame.**

2. **Loosen WB3 × 6 and the knurled screw to stand the PC1 and PC22 board.**

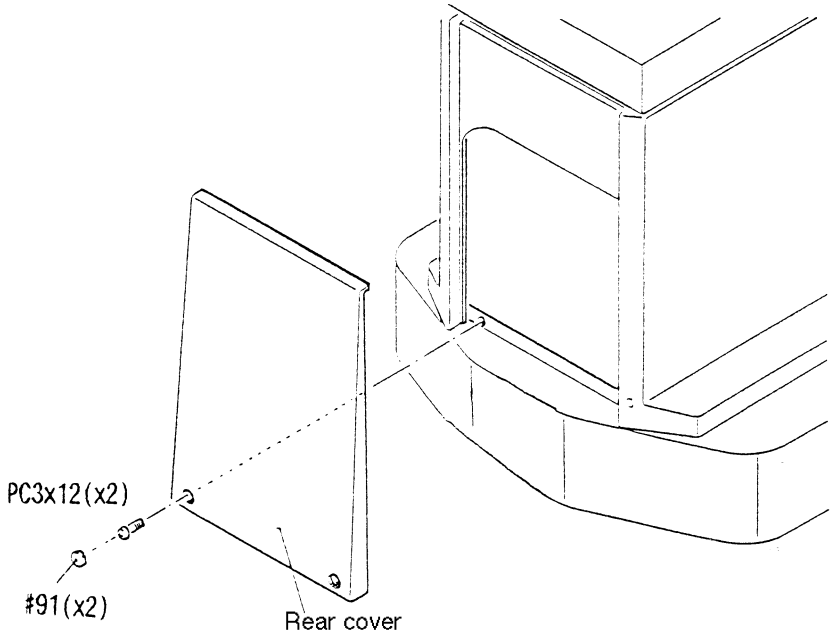
3. **Unscrew PC3 × 4 (n=2) to remove the Inner cover.**



# 5.4 Removing the Rear cover

1. **Remove #91 with a precision driver.**

2. **Unscrew PC3 × 12 to remove the Rear cover.**



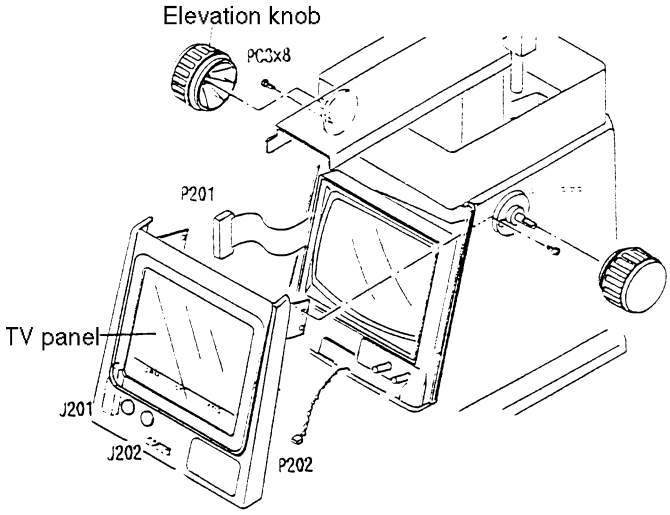
# 5.5 Removing the TV panel

**(For AR-600)**

**1. Pull out the elevation knob.**

**2. Unscrew PC3 × 8 and disconnect the connectors (J201 and J202) to remove the TV panel.**

* In removing the TV panel, first lift it to release the fixing lips of the panel, and then pull the panel forward from the bottom side.

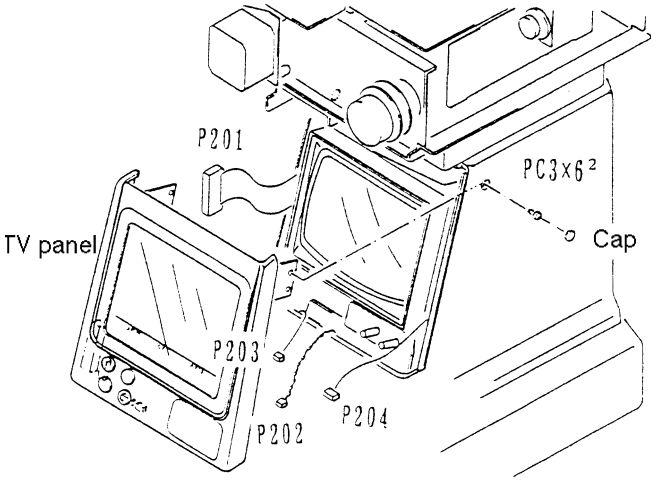



**(For AR-600/AR-700 series except AR-600)**

**1. Remove #91 with a precision driver.**

**2. Unscrew PC3 × 8 and disconnect the connectors (J201, J202, J203 and J204) to remove the TV panel. (J203 and J204 are for the instrument provided with subjective measurement function.)**

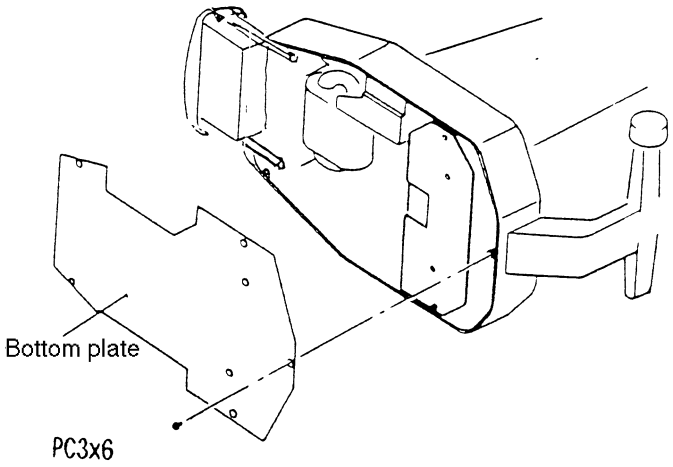
* In removing the TV panel, first lift it to release the fixing lips of the panel, and then pull the panel forward from the bottom side.



# 5.6 Removing the bottom plate of the instrument

1. **Fix the main body to the base with Locking hnob and gently lay down the instrument.**

2. **Unscrew PC3 × 6 and draw the printer unit to remove the bottom plate.**



# §6 Checking the mains supply condition

## 6.1 Checking the supply voltage to AC INLET

1. **Check AC voltage in the wall outlet and between terminals on the table tap with a multimeter. Confirm that the voltages are within ± 10% of the specified voltage. If the obtained voltages are out of ± 10% due to poor electrical environment, it is recommended to use a voltage stabilizer.**

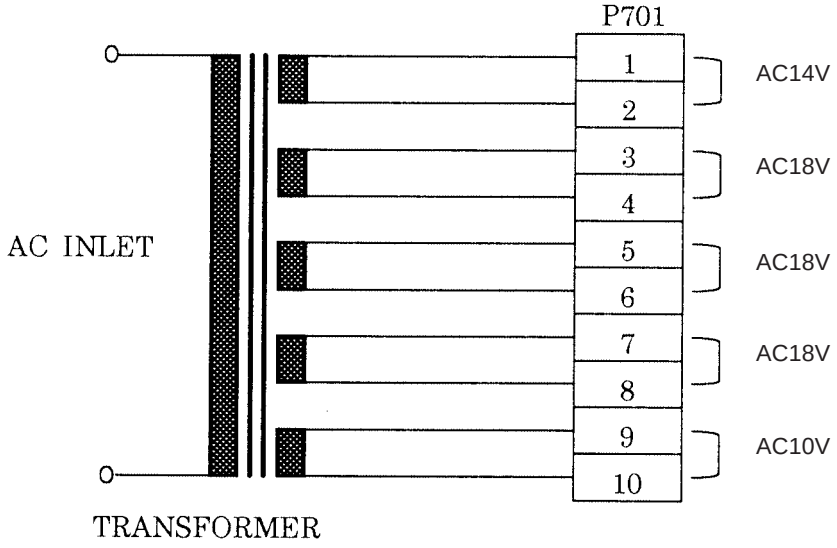
   * Take care not to touch the metal part of the multimeter probe.

## 6.2 Checking the secondary voltage of the transformer

1. **Lay the instrument down and remove the bottom plate. (See 5.6)**

2. **Unscrew PC4 × 8, lift the PC7 board and disconnect the connector (P701). (See 9.5)**

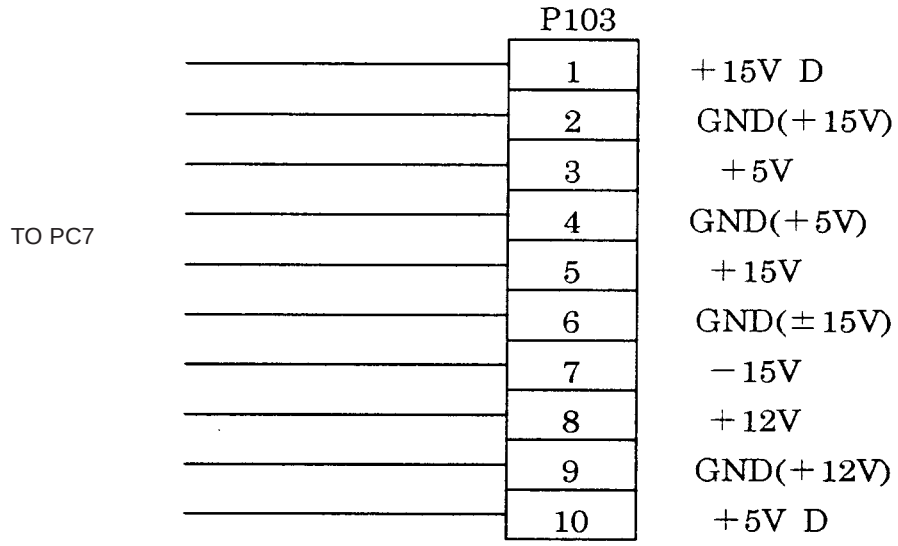
3. **Turn ON the Power switch and check the AC voltage between the following terminals respectively. Confirm that each voltages are within ± 10% of the specified level.**



# 6.3 Checking output voltage on PC7 board

**1. Remove the Left and Right covers. (See 5.1)**

**2. Disconnect the connector P103 on PC1 board and turn ON the Power switch. Check the output voltage between the following pins. Confirm that each voltage are within ± 5% of the specified level.**




* Observe the correct polarity for multimeter's probes.
GND pins on PC7 board and the ones of P103 connector are common pins.

# 6.4 Checking output voltage from backup battery

**1. Remove the Left and Right covers. (See 5.1)**

**2. Remove the frame.**

**3. Check the output voltage from the BT1 on the PC1 board. Confirm that it is within 3V ± 5%.**

* Observe the correct polarity for multimeter's probes.

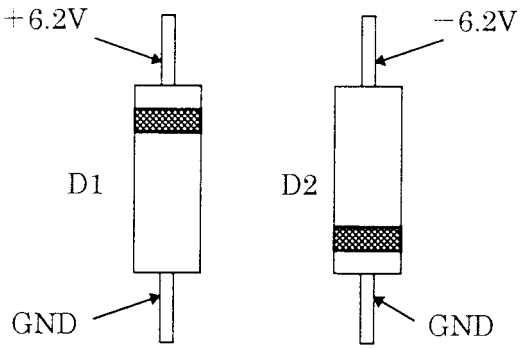
# 6.5 Checking voltage in D1 and D2 on the PC6 board

1. **Remove the Left and Right covers. (See 5.1)**

2. **Remove the frame.**

3. **Turn ON the Power switch. Check the voltage between the leads of two zener diodes. Confirm that it is within ± 5% of the specified voltage.**

   * Observe the correct polarity for multimeter's probes.

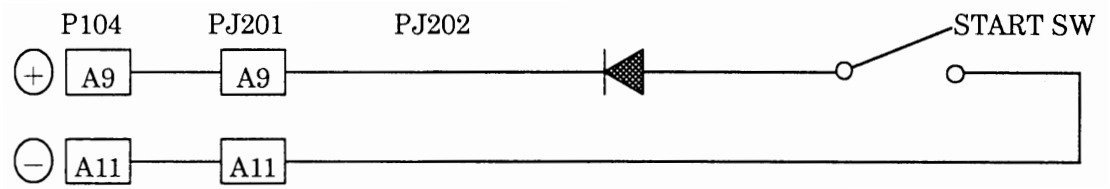


# §7 Checking continuity of switches

Remove the Left and Right covers and frame, and then disconnect the connector P104 to check each switch. As there are a diode for static protection on the circuit, pay attention to polarity of multimeter's probe. Following figures tell plus or minus of multimeter's probe which is connected to each pin.

## 7.1 START SW

Check the continuity between the following pins of P104 to confirm the switch's correct operation.

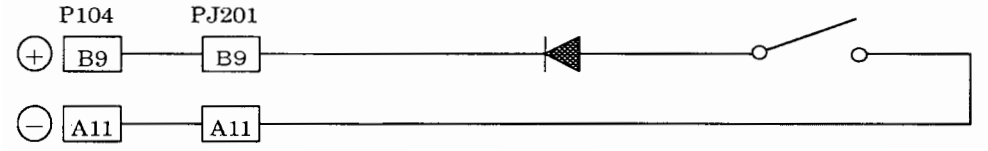



* It is possible that the cables in the Joystick have a break. Confirm that there is no break in the cables while operating the Joystick.

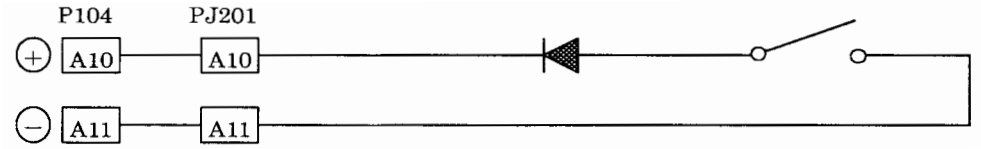
## 7.2 Switches on the PC2 board

Check the continuity between the following pins of P104 to confirm the switches' correct operation.

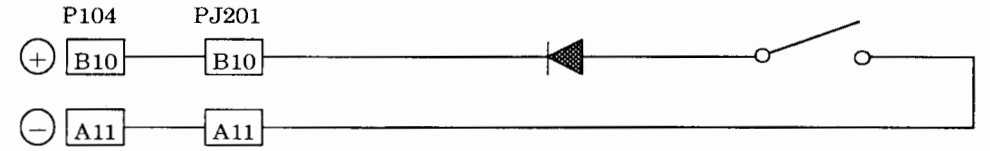
<PRINT SW>



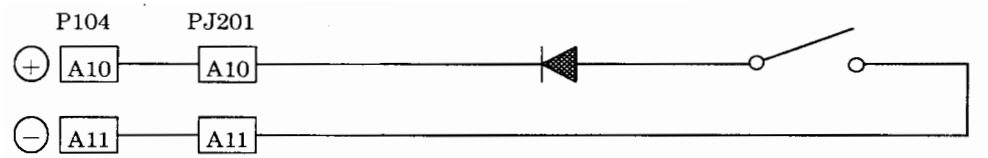

<IOL SW>/For AR-600 series



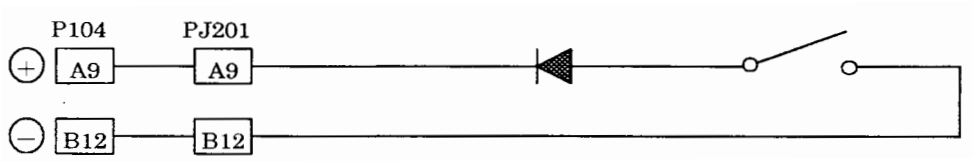

<IOL SW>/For AR-700 series



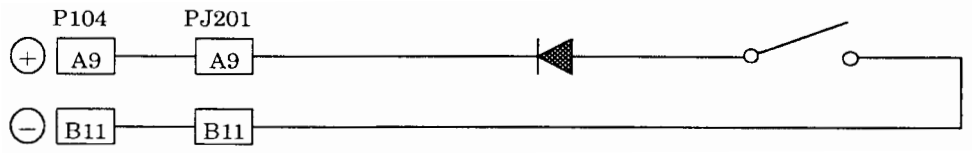

<R/K SW>/Only for AR-700 series



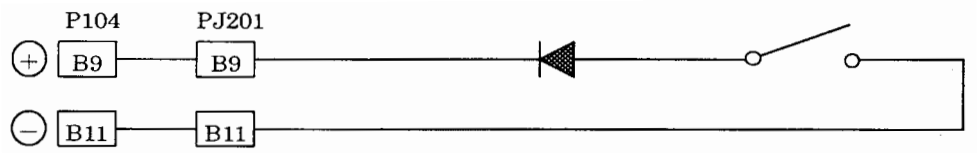
<SCALE SW>



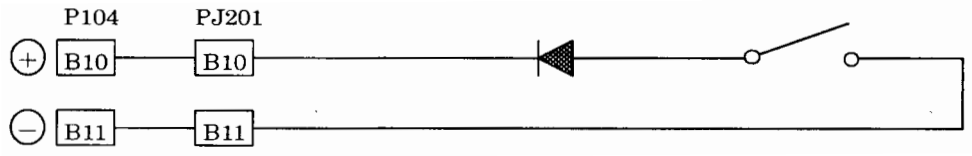

<CYL SW>




<EYE PRINT SW>

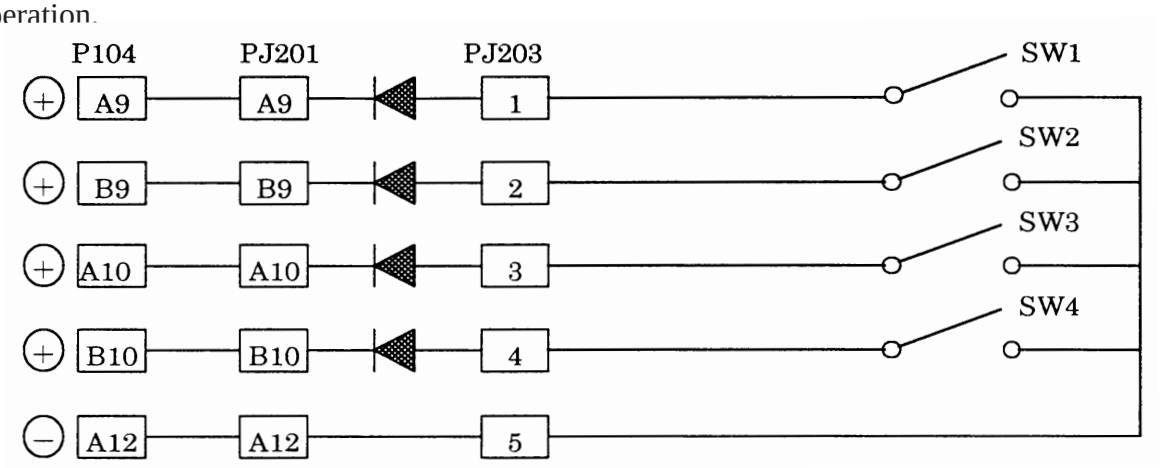



<SET SW>



# 7.3 Switches on the PC3 board (except AR-600)

Check the continuity between the following pins of P104 to confirm the switches' correct operation.

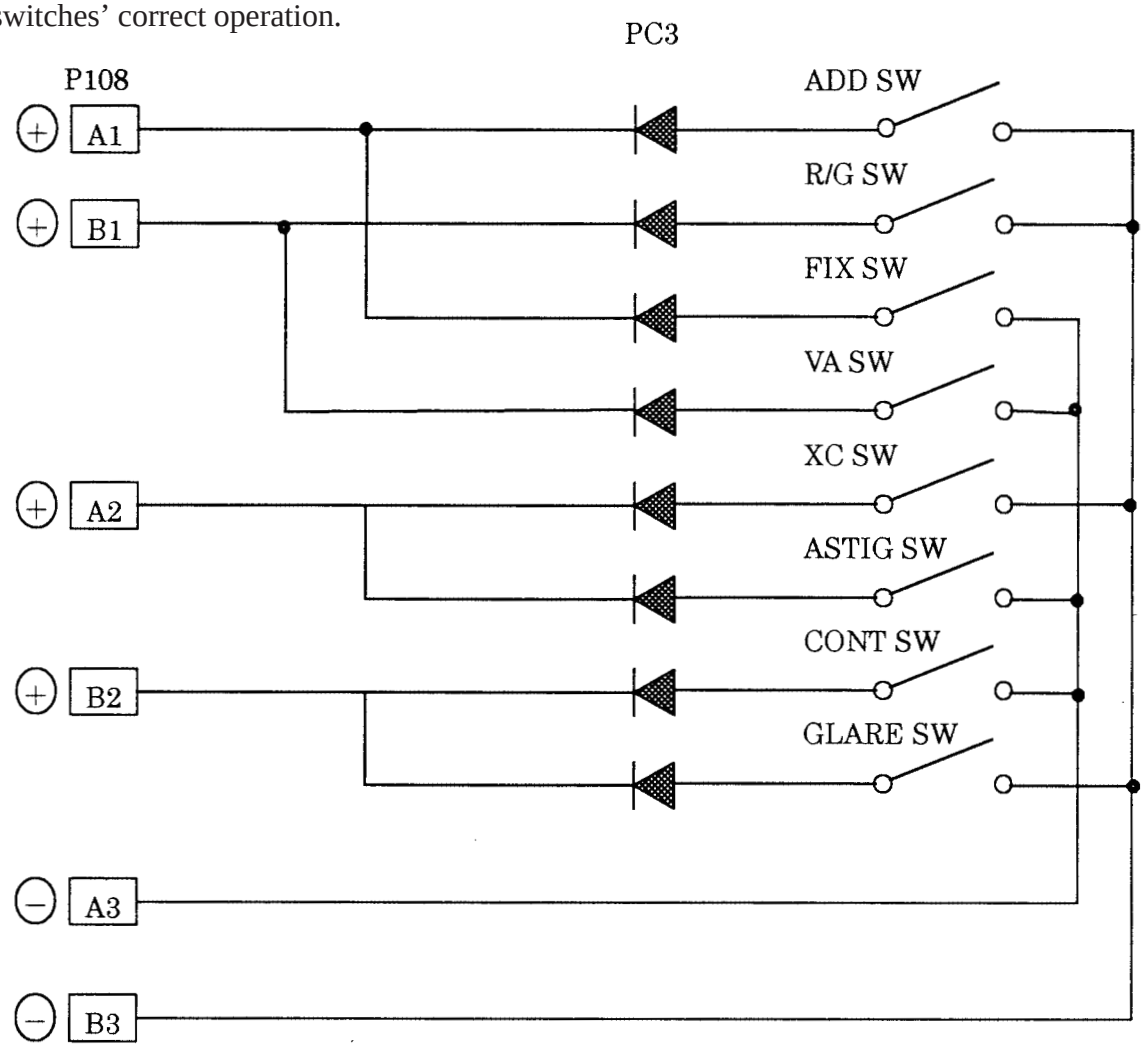



| | AR-600A | AR-660A | ARK-700 | ARK-700A | ARK-760A |
|---|---|---|---|---|---|
| SW1 | ✥ | ▼ | ▼ | ▼ | ▼ |
| SW2 | Ⓐ | ▲ | ▲ | ▲ | ▲ |
| SW3 | | ✥ | | ✥ | ✥ |
| SW4 | | Ⓐ | | Ⓐ | Ⓐ |

Switches' positions and numbers differ according to each model.
See the above table.

# 7.4 Switches on the PC12 board (only for AR-660A and ARK-760A)

Check the continuity between the following pins of P108 to confirm the CHART SELECT switches' correct operation.

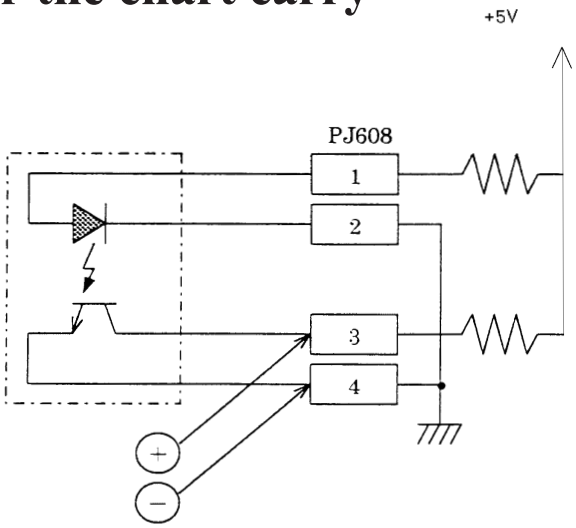


# 8.1 Checking origin sensor for the chart carry

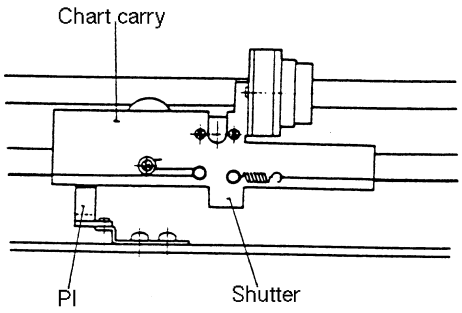
1. **Remove the Left, Right and Inner covers and turn ON the Power switch. (See §5.)**

2. **Slide the Chart carry manually and check the output voltage between 3-pin and 4-pin of PJ608 with a multimeter oncewhile the shutter blocks P1 (photointerrupter), and at the next with no block.**

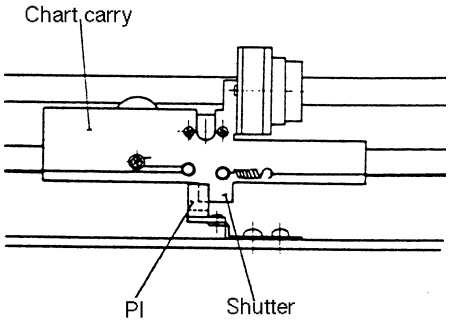
   * Observe the correct polarityshown in the figure for multimeter's probes.




- The output voltage is "LOW (0V)" when the shutter does not block the P1.




- The output voltage is "HIGH (+5V)" while the shutter blocks the P1.



# 8.2 Checking L/R origin sensor (except AR-600 & ARK-700)

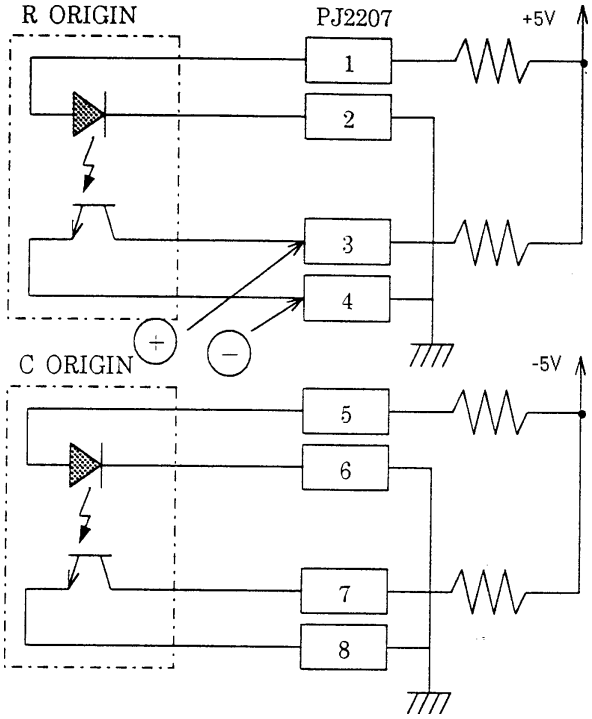
1. **Remove the Left, right covers and Rear cover of the measuring unit and turn ON the Power switch.**
   **(See §5.)**

2. **Attach the Model eye (ARKJ-4) to the Forehead rest.**

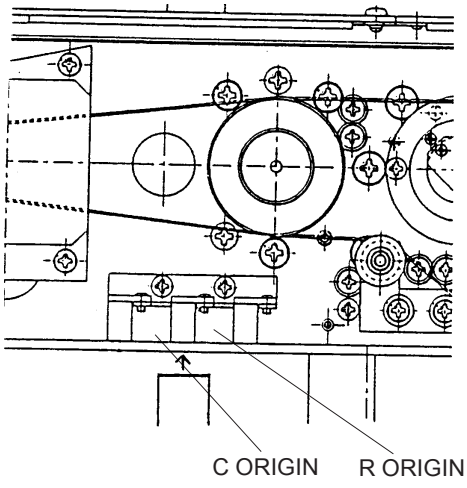
3. **Turn ON the Auto-tracking button.**

4. **Check the output voltage between 3 - 4 pin, and 7 - 8 pin of J2207 with a multimeter once while a sort of Kent paper blocks the P1 (photo-interrupter), and at the next with no block.**

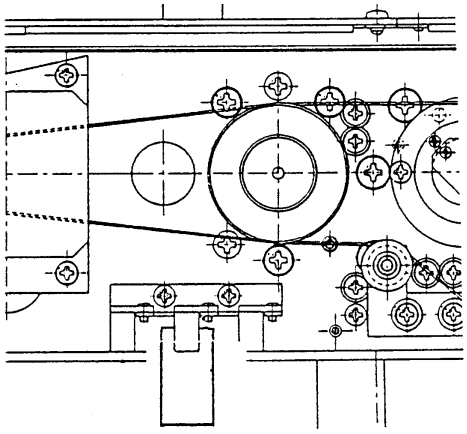
   * Observe the correct polarity shown in the figure for multimeter's probes.




- The output voltage is "LOW (0V)" when a Kent paper does not block the P1.




- The output voltage is "HIGH (+5V)" when a Kent paper does not block the P1.

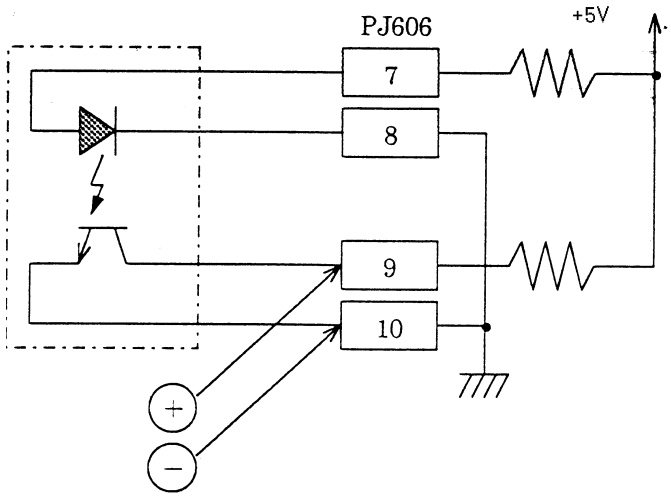


L ORIGIN sensor is provided for the early models but it is not used.

# 8.3 Checking the Origin sensor for the Rotator

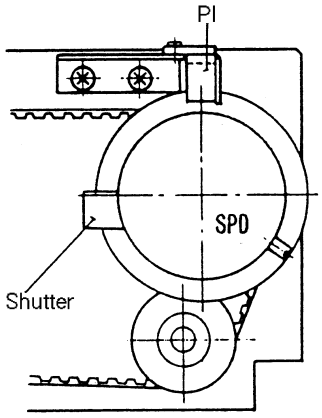
1. **Remove the Left, Right covers and Rear cover of the measuring unit and turn ON the Power switch. (See § 5.)**

2. **Rotate the SPD clockwise and Check the output voltage between 9-pin and 10 - pin of PJ606 with a multimeter while a shutter blocks the P1 (photo-interrupter) and while it does not block the P1.**

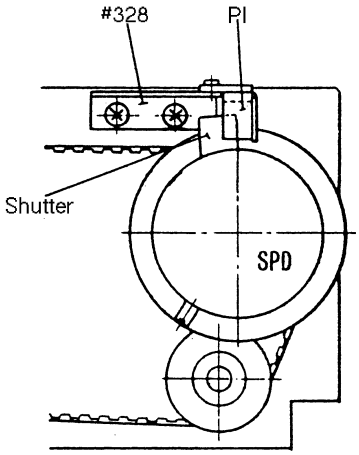



* Observe the correct polarity shown in the figure for multimeter's probes.

- The output voltage is "LOW (0V)" when the shutter does not block the P1.




- The output voltage is "HIGH (+5V)" while the shutter blocks the P1.



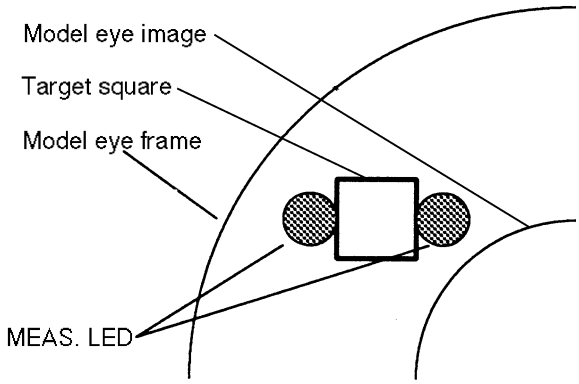
# 8.4 AR measurement LED and LED cable

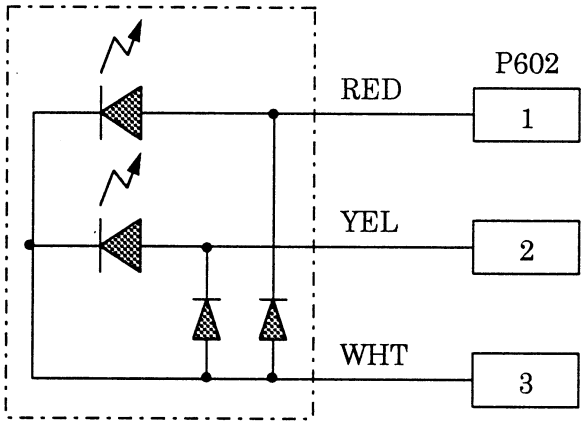
1. **Remove the Left and Right covers and turn ON the Power switch. (See 5.1.)**

2. **Attach the Model eye (ARKJ-4) to the Forehead rest.**

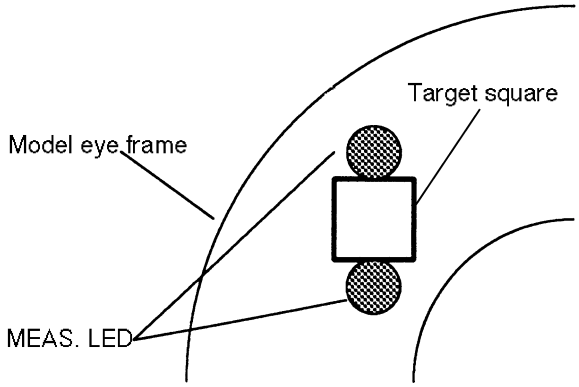
3. **Set Switch 4 of switchpack SW1 on the PC1 board to the ON position. Press the Start button once to place the instrument to the "mode 1". (See § 12.)**

4. **Put the target square within the model eye frame. Two lights of light source LED for AR measurement LED appears by moving the Main body back and force.**
   **At that point, move the LED cable and check to see that the lights do not blink. The blinking lights show signs of breaking LED cable.**
   **If the LED is not lit, check the continuity between 1-3 pin and 2-3 pin with a multimeter.**
   **Since the LED is included in the circuit, a multimeter will not read 0Ω.**
   **But if the LED cable has a break, a multimeter will show no indication.**
   **The polarity of probes of multimeter does not matter.**




5. **Rotate SPD clockwise and check to see that the target square is tangent to two lights of LED.**



# 8.5 Checking the ILLUMI. LED voltage

1. **Remove the Left , Right covers and frame. Then disconnect the connector P614. Turn on the Power Switch. (See § 5.)**

2. **Check the voltage between 1-pin and 2-pin of J614 with a multimeter. Confirm that it reads around + 5V.**

* Multimeter's probe (+) 1 pin
(-) 2 pin

# 8.6 Checking the Chart lamp voltage

1. **Remove the Left, Right covers and frame. Then disconnect the connector P617. Turn on the Power Switch. (See § 5.)**

2. **Check the voltage between 1-pin and 2-pin of J617 with a multimeter. Conform that it reads around + 5V.**

* Multimeter's probe (+) 1 pin
(-) 2 pin

# 8.7 Checking the alignment light LED voltage

1. **Remove the Left, Right covers and frame. Then disconnect the connector P613. Turn on the Power Switch. (See § 5.)**

2. **Check the voltage between 1-pin and 2-pin of J613 with a multimeter. + 12V with pulse having a period of 0.5sec. is applied to J613 on the circuit. Since the multimeter measures the stable voltage, its needle moves slowly. If the meter indicates slightly upscale, the voltage is normal.**

* Multimeter's probe (+) 1 pin
(-) 2 pin

# 8.8 Checking the PD LED voltage

1. **Remove the bottom plate and disconnect the connector P706. Turn ON the Power Switch. (See 5.6.)**

2. **Check the voltage between 1-pin and 2-pin of J706 with a multimeter. Confirm that it reads around + 5V.**

* Multimeter's probe (+) 1 pin
(-) 2 pin

# 8.9 Checking the FOCUS LED voltage (only for AR-600A, AR-660A)

1. **Remove the Left and Right covers. Then disconnect the connector P615. Turn ON the Power Switch. (See 5.1.)**

2. **Check the voltage between 1-2-pin and 7-8 pin of J615 with a multimeter. Confirm that it reads around + 5V.**

   * Multimeter's probe (+) 1 , 7 pin
     (-) 2, 8 pin

# 8.10 Checking the AKM LED voltage (only for AR-700 series)

1. **Remove the Left and Right covers. Then disconnect the connector P615. Turn ON the Power Switch. (See 5.1.)**

2. **Check the voltage between 1-2 pin, 3-4 pin, 5-6 pin and 7-8 pin of J615 with a multimeter. Confirm that it reads around + 5V.**

   * Multimeter's probe (+) 1 , 3, 5, 7 pin
     (-) 2, 4, 6, 8 pin

# 8.11 Checking the AKM LED voltage (except AR-600)

1. **Remove the Left and Right covers. Then disconnect the connector P616. Turn ON the Power Switch. (See 5.1.)**

2. **Check the voltage between 1-3 pin and 2-3 pin of J616 with a multimeter. Confirm that it reads around + 12V.**

   * Multimeter's probe (+) 1, 2 pin
     (-) 3 pin

# §9 *Replacing circuit boards*

## 9.1 Replacing PC1 (MAIN) board

Replacement parts: 32906-BA01/ ROM (IC2 and IC3) is not included in the P.C.B.

1. **Remove the Left, Right covers and frame. (See § 5.)**

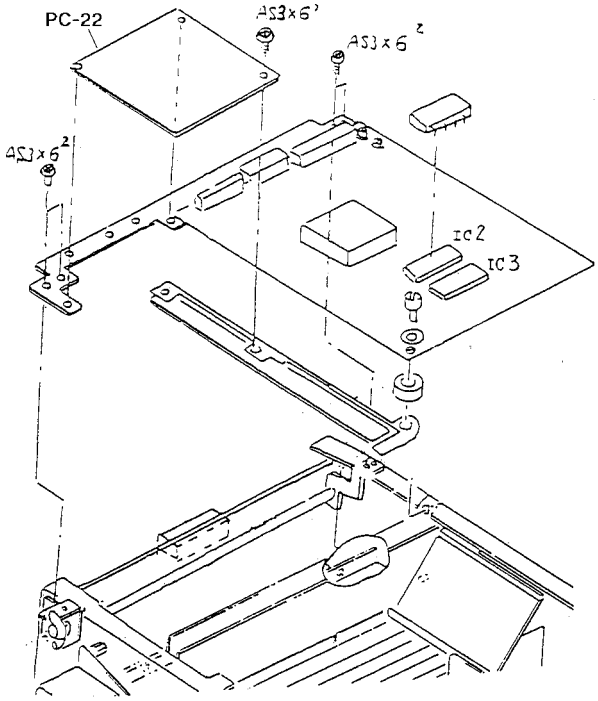
2. **Remove all the connectors from the board.**

3. **Take out the PC22 board by screwing AS3 × 6. (See 9.9)**
   * The PC22 board is not used in AR-600 and ARK-700.

4. **Unscrew AS3 × 6 and take out the PC1 board (with heat radiating plate).**

5. **Unscrew the knurled screw and the screws fixing the PC1 board and attach them on the new PC1 board.**

6. **Extract ROM and mount it onto the new board.**




7. **Set SW1 and SW2 according to "§ 14 List of SW1 and SW2 functions on the PC1 board".**
   * The PC1 board including ROM can be commonly used in the AR-600 and ARK-700 series. However, the setting of SW1 and SW2 differs according to the model and destination.

8. **Set the parameter, date and time and input comments, referring to Operator's manual. Then check the instrument for proper operation.**

# 9.2 Replacing PC2 (DISPLAY) board

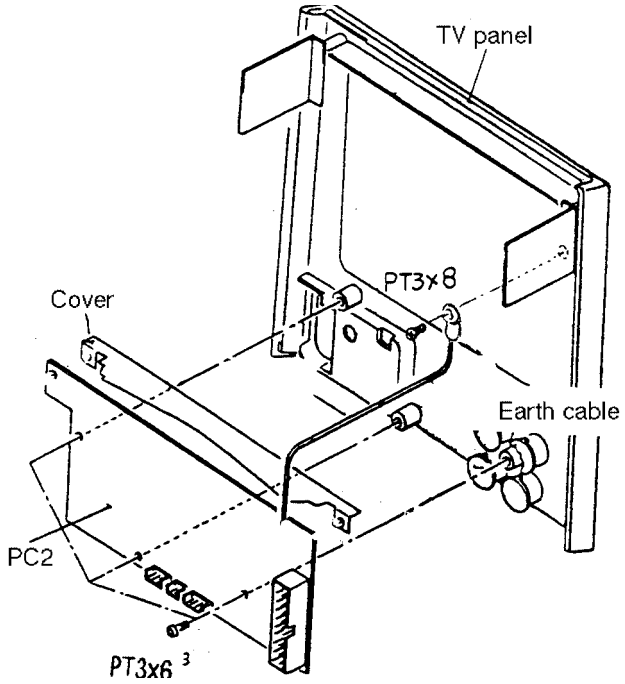
Replacement parts: 32906-BA02

1. **Remove the TV panel. (See § 5.)**

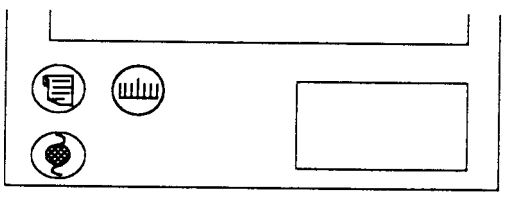
2. **Unscrew PT3 × 8 and PT3 × 6 (n=3) to take the PC2 out.**

3. **Take off the Cover from the PC2 board and attach it to the new P.C.B with an adhesive tape.**

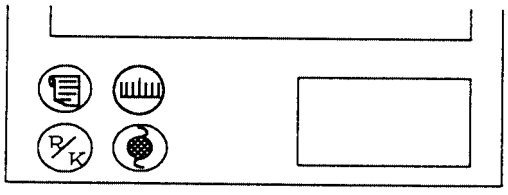
   * If a button is off, return it to the original position, following the figures below.
   Note that the buttons position differs according to the model. After replacing the board with a new one, check the buttons for correct operation.




FOR AR-600 SERIES

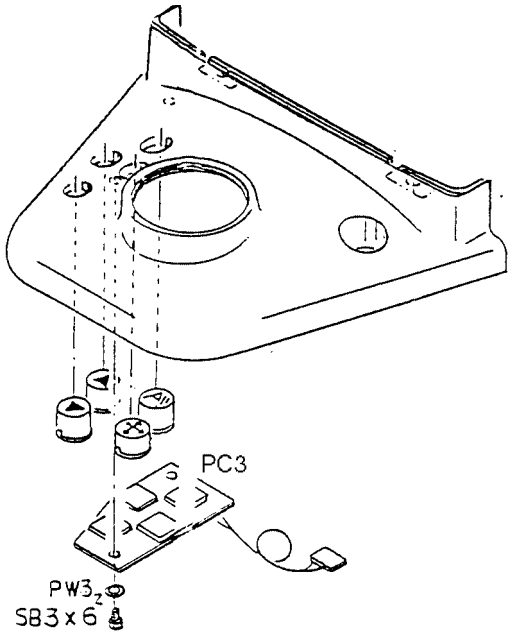


FOR AR-700 SERIES



# 9.3 Replacing PC3 (INC.DEC SW) board (except AR-600)

Replacement parts: 32907-EA03

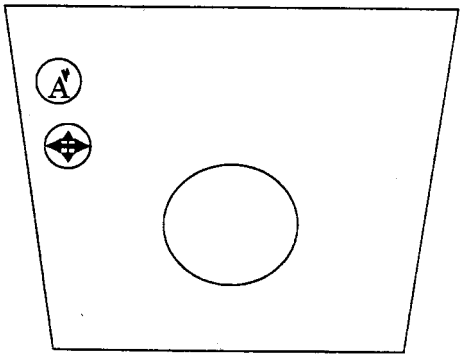



1. **Remove the Rear cover and TV panel. (See § 5.)**

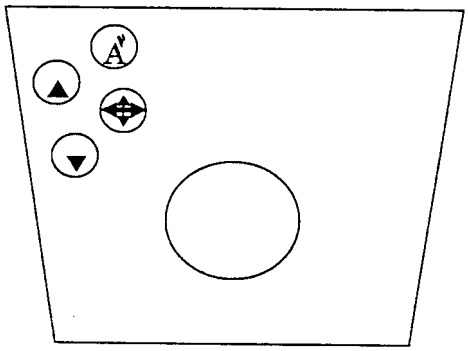
2. **Remove the Joystick (See 10.2).**
   * It is possible to take out the PC3 board without disconnecting the wiring of the Joy stick.

3. **Unscrew SB3 × 6 (n=2) to replace PC3 with a new one.**
   * If a button is off, return it to the origina position, following the figures below. Note that the buttons position differs according to the model. After replacing the board with a new one, check the buttons for correct operation.

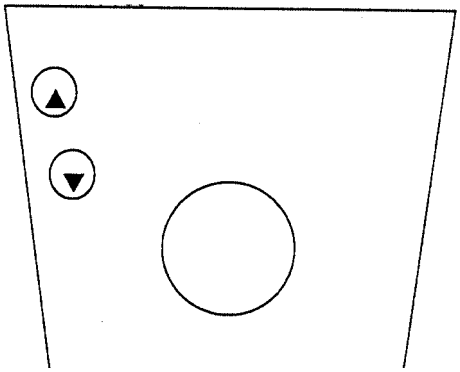
For AR-600A



For AR-660A, ARK-700A and ARK-760A

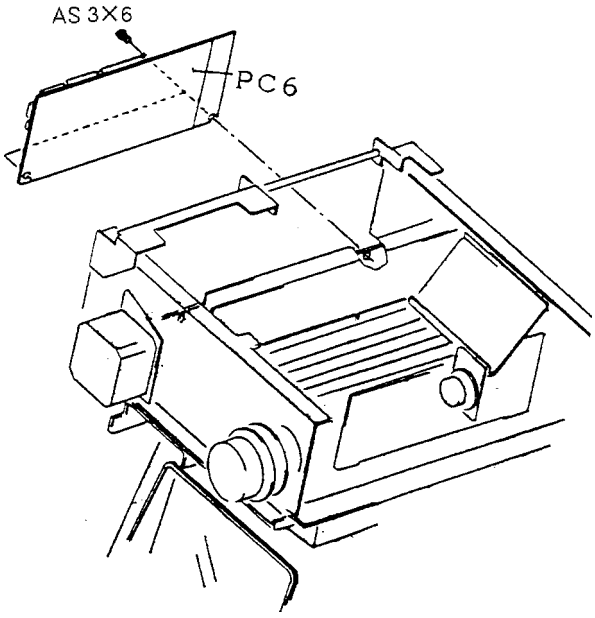


For ARK-700



# 9.4 Replacing PC6 (ADJUST) board

Replacement parts: 32906-BA06




**1. Remove the Left, Right covers and frame. (See § 5.)**

**2. Remove all the connectors from the board.**

**3. Unscrew AS3 × 6 (n=2) and replace the PC6 board with a new one.**

* The connectors on the P.C.B is quite alike. When mounting the connectors on the new P.C.B, pay attention to the connector No. For details of each connector, see the WIRING DIAGRAM attached to this manual.

**4. Mount the IC2 (E2PROM) on the former PC6 board to the new P.C.B. except when "Err9" (MEMORY FAILURE ON E2PROM) appears.**

* If "Err9 (MEMORY FAILURE ON E2PROM" arises, follow the troubleshooting on 3.2.8.

**5. Set the volume of VRs on the new PC6 as before. Note that VR9 should not be turned to CW over 3:00 position.**

**6. Set the parameter, date and time and input comments, referring to Operator's manual.**

**7. Perform sensor calibration. (See 11.6.)**

**8. When replacing the IC2 (E2PROM), perform tracking calibration and KM auto-calibration. (See 11.11.)**

**9. Check the instrument for proper operation.**

Functions of VRs

VR1: S. GAIN
VR2: S. ZERO
VR3: AR LED R
VR4: AR LED L
VR5: KM LED 1
VR6: KM LED 2
VR7: KM LED 3
VR8: KM LED 4
VR9: MIRE LED
VR10: ALIGN. LED
VR11: ILLUMI LED

# 9.5 Replacing PC7 (POWER SUPPLY) board

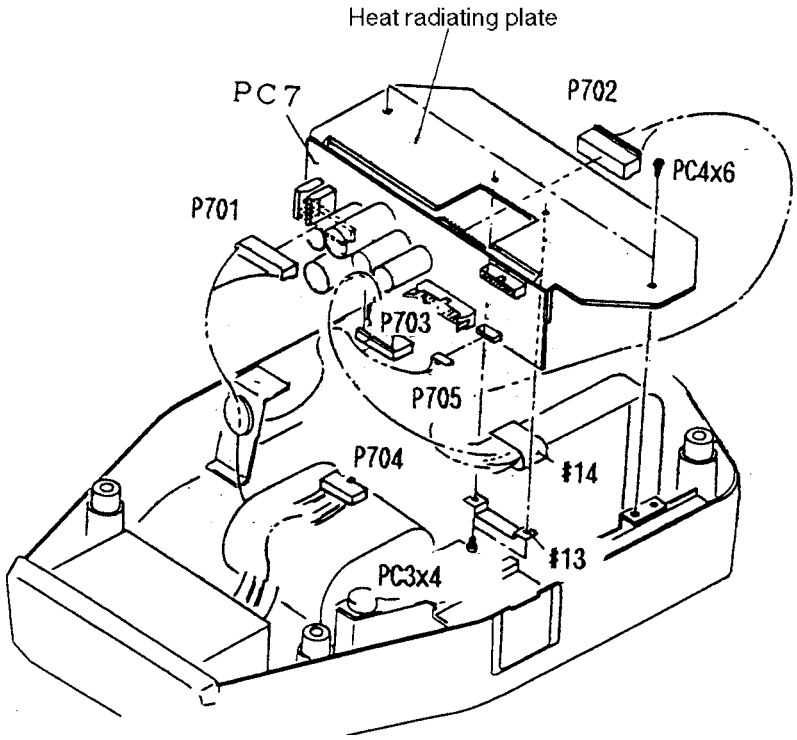
Replacement parts: 32906-BA07

1. **Fix the Main body to the Base with Locking knob, gently lay down the instrument. Then remove the bottom plate of the main body.**

2. **Unscrew PC4 × 6.**

3. **Remove PC3 × 4, #13, #14 and replace the PC7 board with a new one.**

   * Apply heat sinker to the whole heat radiating plate of the PC7 board. Arrange the cables so that they do not interfere with taking-in and out of the printer.



# 9.6 Replacing PC8 (PRINTER) board and printer

(For AR-600 and ARK-700)
Replacement parts (PC8) : 32903-E5008
(PRINTER) : 806-06-00007 line printer

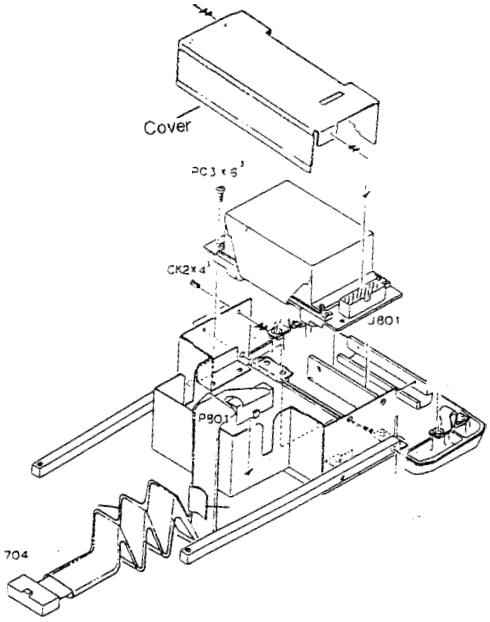
1. **Draw out the printer, turn the gear seen on the cover backward to take out the used paper roll.**

2. **Unscrew CK2 × 4 (n=3) to take off the Cover.**

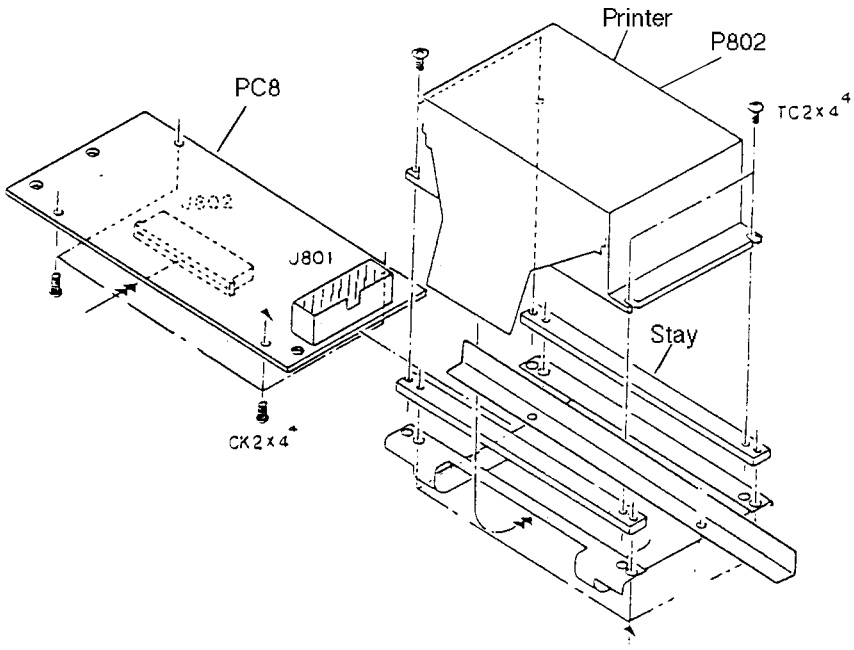
3. **Unscrew PC3 × 6 (n=3), a connector to take off the Printer and the PC8 board.**

4. **Unscrew TC2 × 4 and the connector P802 to replace the printer with a new one.**

   * Do not touch the cable contact of the connector P802 directly with hands. If it gets dirty, wipe it with acetone. Also note that the cable contact may be damaged by connecting and disconnecting the connector five or six times.

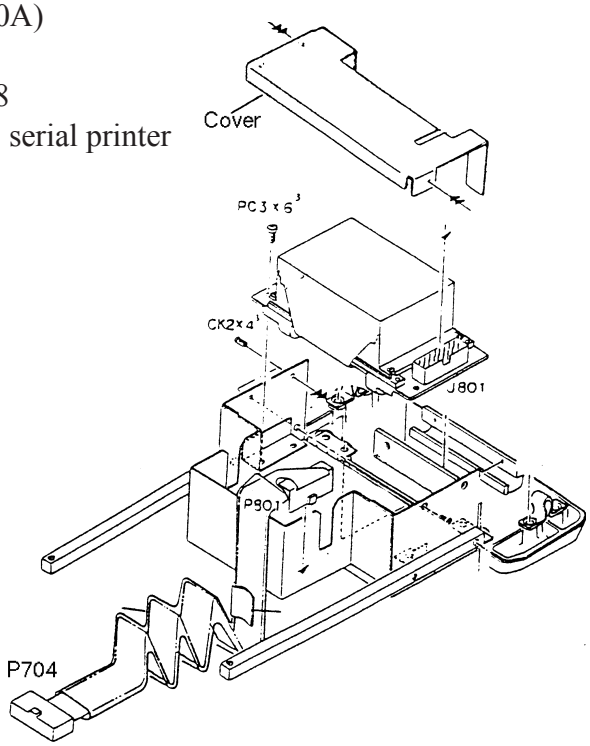



5. **Remove CK2 × 4 (n=4) and the Stay to replace the PC8 board.**



(For AR-600A, AR-660A, ARK-700A and ARK-760A)

Replacement parts (PC8) : 32907-BA08
(PRINTER) : 32907-E022 serial printer




1. **Draw out the printer, turn the gear on the cover backward to take out the used paper roll.**

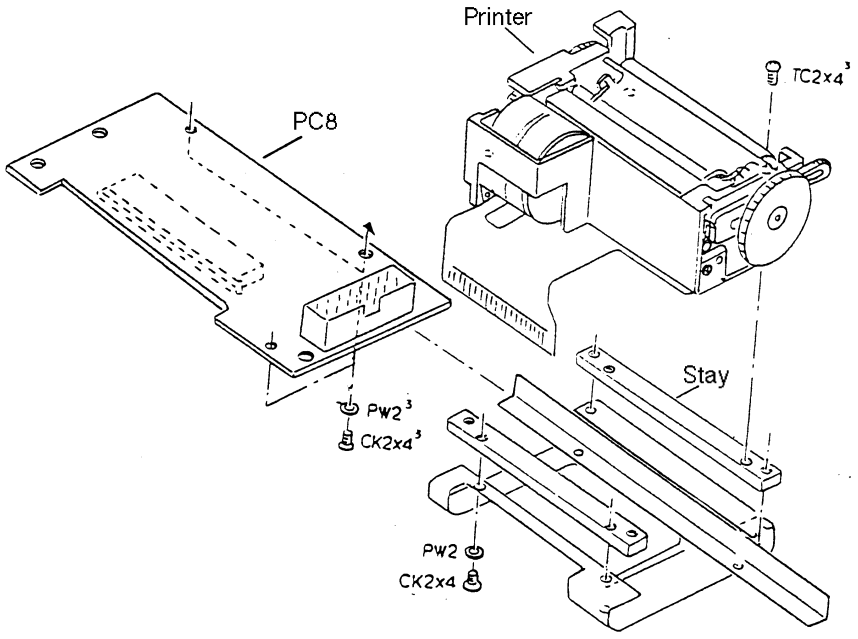
2. **Unscrew CK2 × 4 (n=3) to take off the Cover.**

3. **Remove PC3 × 6(n=3), a connector to take off the Printer and the PC8 board.**

4. **Remove TC2 × 4 (n=2) and the connector J802 to replace the printer with a new one.**

   * Do not touch the cable contact of the connector J802 directly with hands. If it gets dirty, wipe it with acetone. Also note that the cable contact may be damaged by connecting and disconnecting the connector five or six times.

5. **Unscrew CK2 × 4 (n=3) and to replace the PC8 board.**



# 9.7 Replacing PC10 (MIRE) board

(For ARK-700 series)

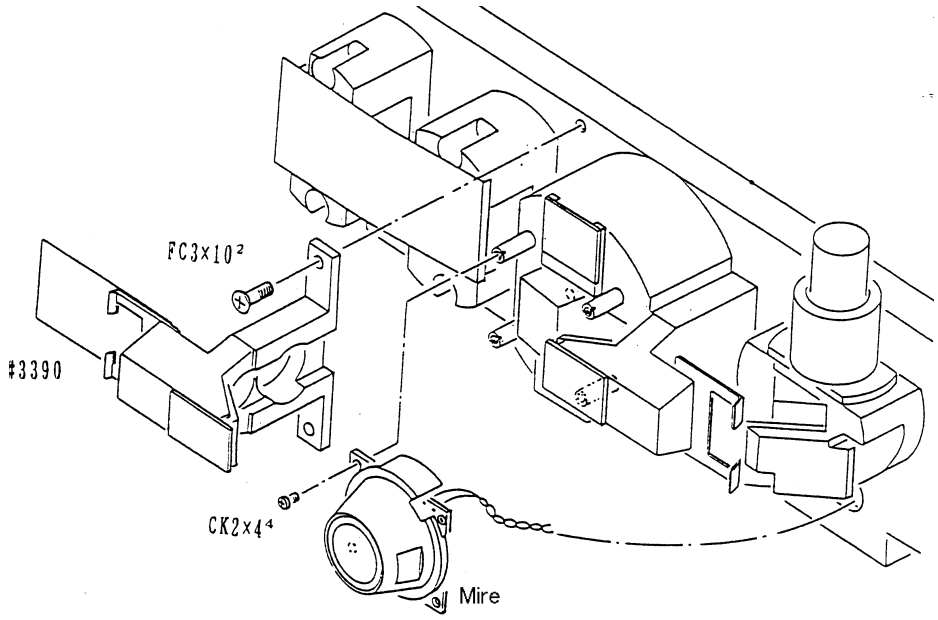
Replacement parts: 32158-3380
: 80423-10002 (tie wrap)

**1. Remove the Left, Right and Front covers. (See § 5.)**

**2. Unscrew FC3 × 10 (n=2) and to take the #3390 off.**

**3. Unscrew CK2 × 4 (n=4), replace the MIRE and tie the cables together as before.**

**4. Perform auto-tracking and auto-shot calibrations and KM auto-calibration. (see 11.11.)**



(For AR-600A, AR-660A)

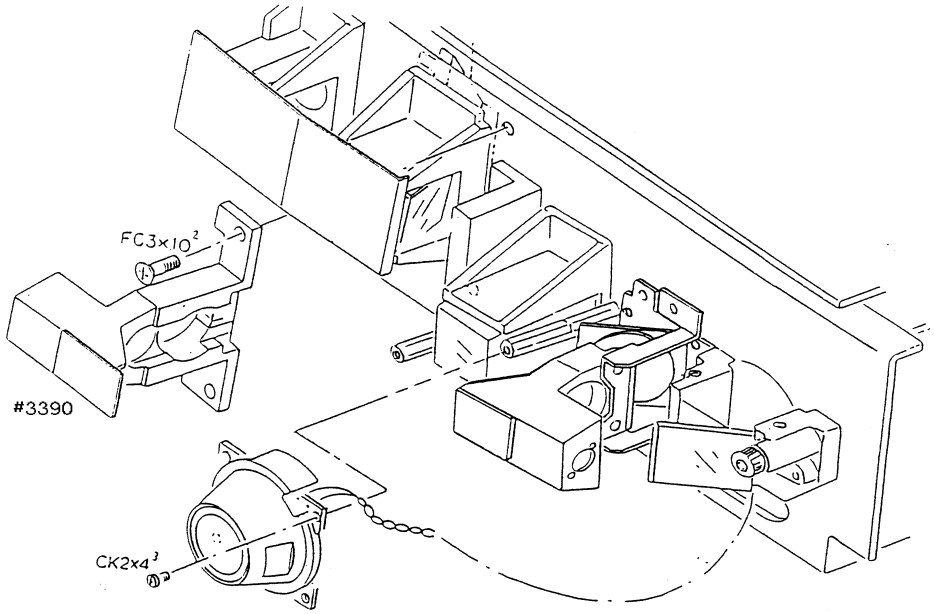
Replacement parts: 32907-3380
: 80423-10002 (tie wrap)

**1. Remove the Left, Right and Front covers. (See § 5.)**

**2. Unscrew FC3 × 10 (n=2) to take the #3390 off.**

**3. Unscrew CK2 × 4, replace the MIRE and tie the cables together as before.**

**4. Perform auto-tracking and auto-shot calibration. (See 11.11.)**



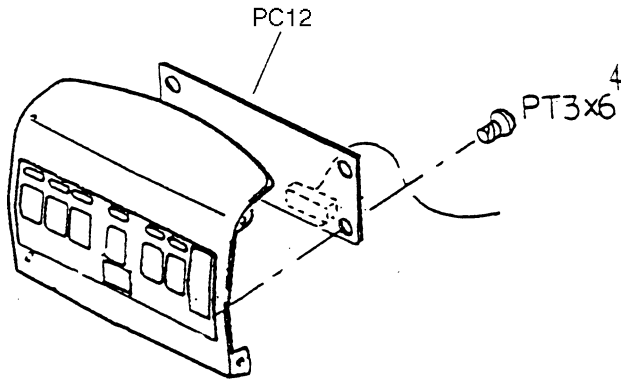
# 9.8 Replacing PC12 (CHART SELECT SW) board

(For AR-660A, ARK-760A)

Replacement parts: 32908-EA12

**1. Remove the Left, Right and Rear covers. (See § 5.)**

**2. UnscrewPT3 × 6 (n=4) and then replace the PC12 board with a new one.**

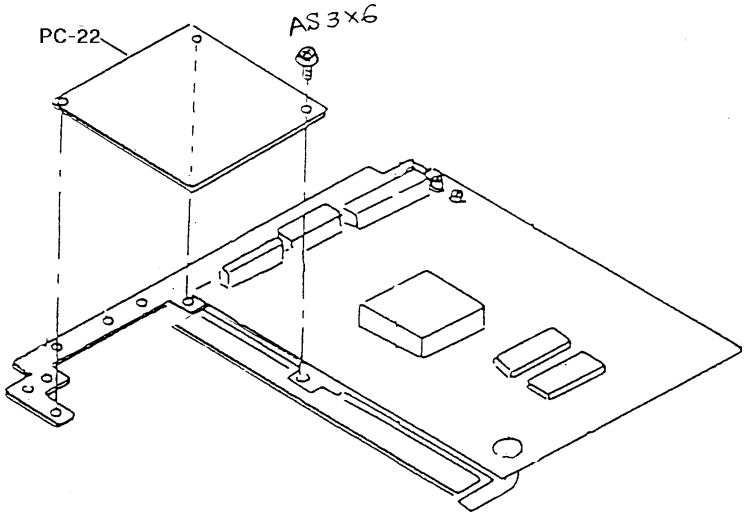


# 9.9 Replacing the PC22 (TRACKING) board

(For AR-660A, AR-660A, ARK-700A, ARK-760A)

Replacement parts: 32907-BA22

1. **Unscrew AS3 × 6 (n=3) and disconnect J1 from the PC1 board, and J2201 from the PC22 board.**

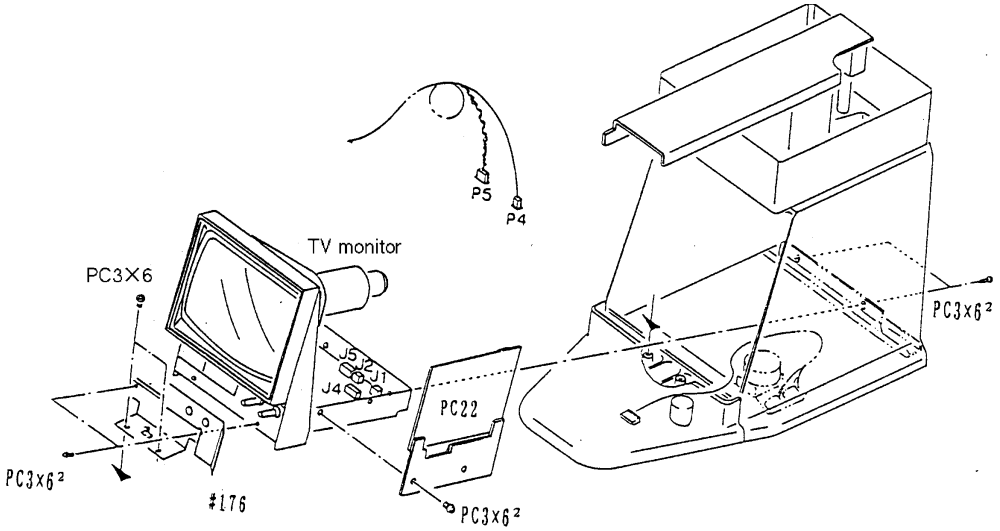



(For ARK-700)

Replacement parts: 32156-BA22

1. **Take the TV monitor off. (See 10.17.)**

2. **Unscrew AS3 × 6 (n=3) and replace the PC22 board with a new one.**



# 9.10 Replacing the PC23 (PD CCD) board

Replacement parts PC23: 32906-BA23
Shading paper: 32906-M528

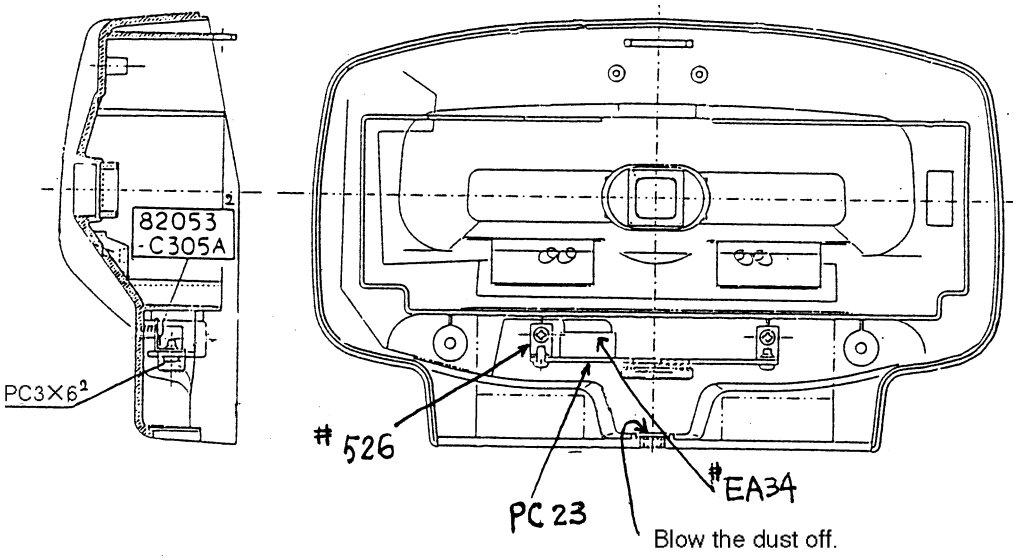
1. **Remove the Left, Right and Front covers. (See § 5.)**

2. **Remove the #528 (shading paper).**

3. **Remove #82053-C305A(n=2), #526, the PC23 board and #EA34.**

4. **Remove PC3 × (n=2), #526 and then replace the PC23 board to the new one.**
   * Do not touch the photoreceptor CCD.
   Note that CCD is easily damaged by static electricity.

5. **Affix the new #528 (shading paper).**
   * If the dust settles on the filter, blow the dust off with a blower.

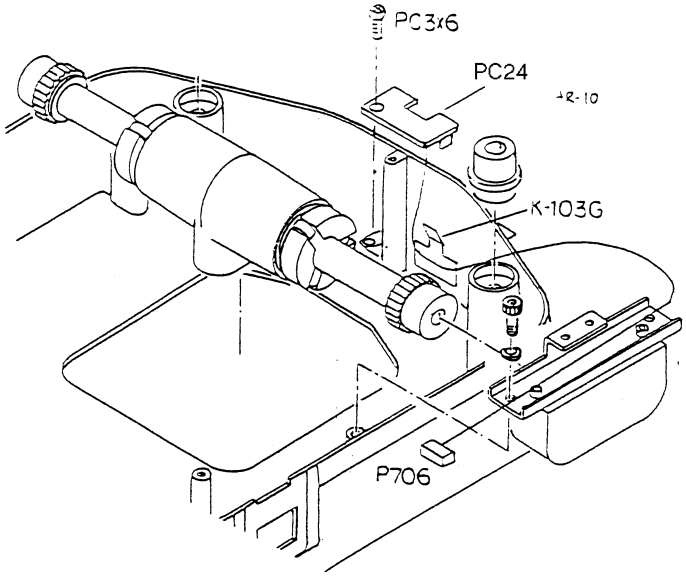


# 9.11 Replacing the PC24 (PD LED) board

Replacement parts PC24: 32906-EA24

**1. Take off the Bottom plate. (See 5.6.)**

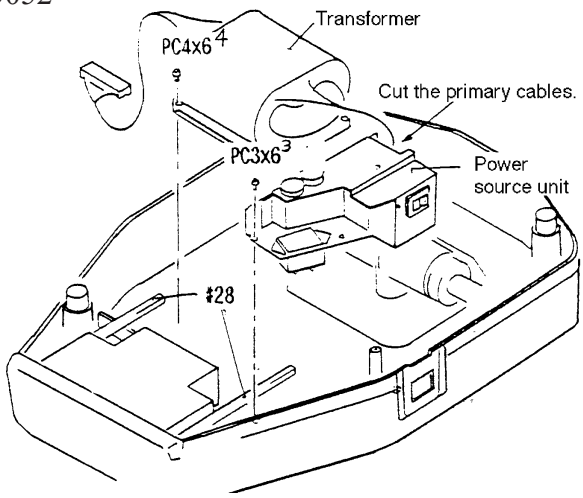
**2. Replace the PC24 board with a new one.**
* Check to see that the LED stands straight.



# §10 Replacing parts

## 10.1 Replacing the transformer

Replacement parts (100V series) : 32903-E5051
(200V series) : 32903-E5052



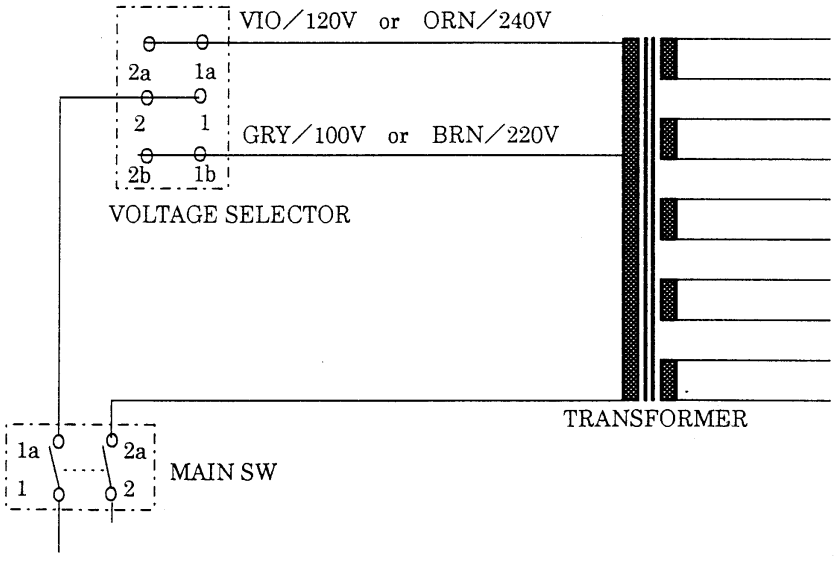

1. **Remove the bottom plate. (See 5.6.)**

2. **Take out the PC7 board. (See 9.5.)**

3. **Unscrew PC4 × 6 (n=4) and PC3 × 6 (n=3) and then take the power source unit out.**

4. **Cut off three primary cables of the Power source unit, take away the transformer from the power source unit.**

5. **Desolder the above cables from the transformer and replace it with a new one.**
   * Route the wires following the wiring diagram below. Insulate the soldered sections with heat shrink tubes. Arrange the cables so that they do not interfere with #28 when taking in and out the printer.



# 10.2 Replacing the Joystick

Replacement parts:

| AR-600 | ARK-700 | AR series except AR-600 And ARK-700 |
|---|---|---|
| 32906-2080 | 32158-2090 | 32907-2080 |

**1. Remove the TV panel. (See 5.5.)**

**2. Take out the Rear cover. (See 5.4.)**
* For ARK-700, remove the connectors on the PC22 board which is on the side of the monitor.

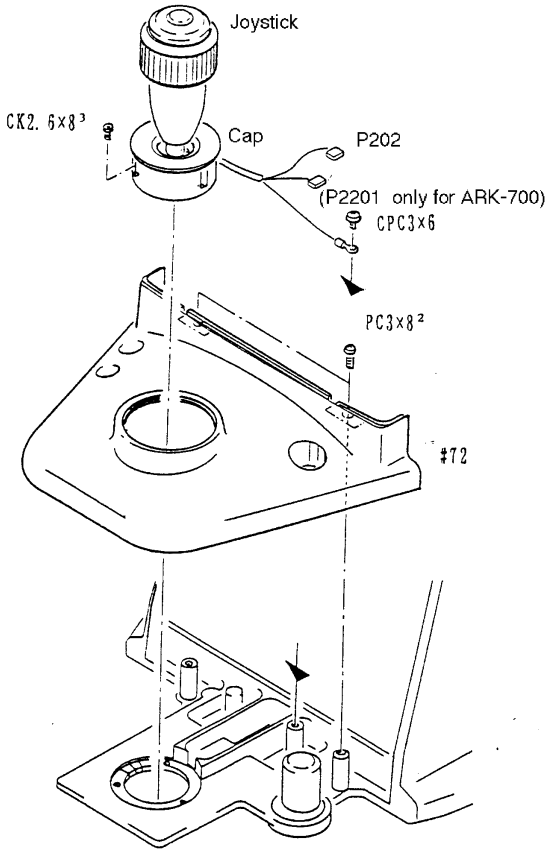
**3. Remove the Cap.**
* Be careful not to scratch #72. Also be careful not to crack the hooks on the cap.

**4. Unscrew CK2.6 × 8 (n=3).**

**5. Remove PC3 × 8 (n=2) and #72.**

**6. Unscrew CPC3 × 6 to release the ground cable.**

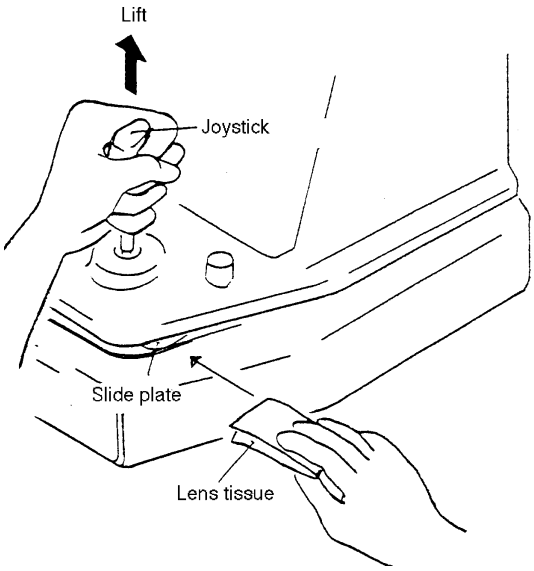
**7. Disconnect the connector P202 and replace the Joystick with a new one.**
* When assembling the removed parts, pay attention to the arrangement of the cables.



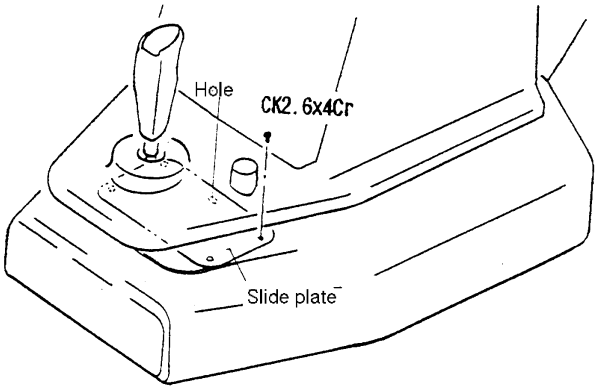
# 10.3 Cleaning and replacing the Slide plate

Replacement part: 32906-M004

1. **If the slide plate gets dirty, the movement of the main body on a plane becomes worse. In such cases, grip and lift the Joystick and insert a lens tissue with acetone between the base and the main body and wipe the slide plate, sliding the main body.**



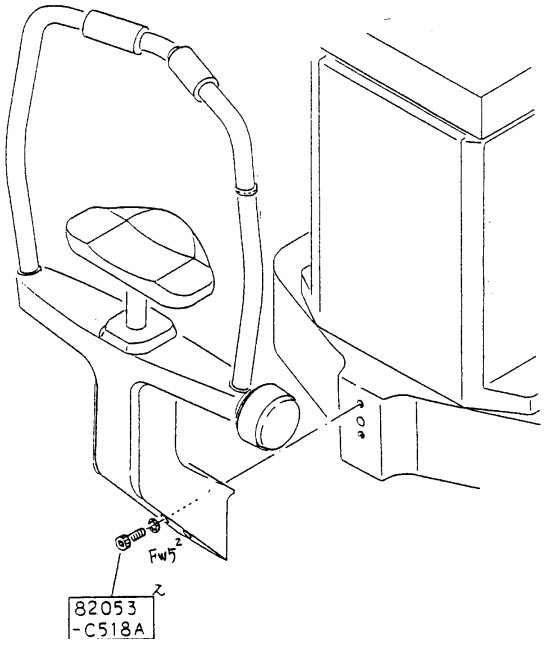

2. **If the slide plate gets scratched, the movement may not be improved. In such cases, unscrew CK2.6 × 4 (n=4) and replace the slide plate with a new one.**
   * Pay attention to the fixed orientation of the plate.



# 10.4 Replacing LED and cleaning IR filter

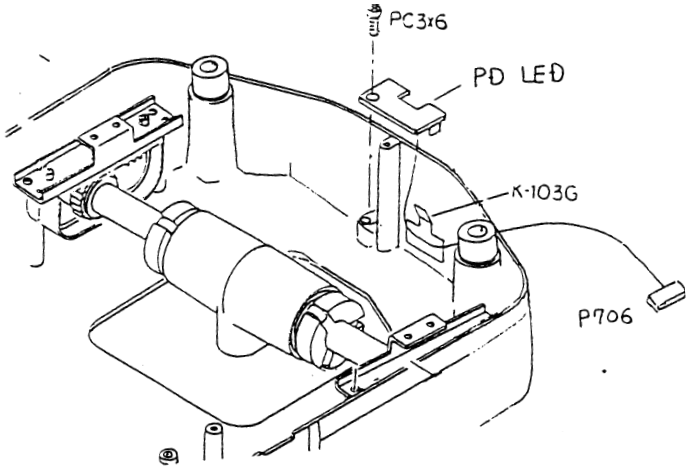
Replacement part: 32906-EA24

1. **When "PD ERR" occurs, first clean the IR filter at the foot of the Head rest.**
   * Cleaning is easily done by removing the Chin rest. To finish the cleaning, use the acetone.



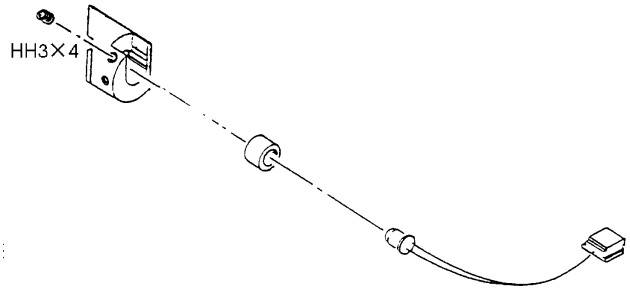

2. **Remove the Bottom plate. (See 5.6.)**

3. **Unscrew PC3 × 6 and replace the PD LED with a new one.**
   * Make sure that the LED stands straight for the P.C.B.



# 10.5 Replacing LED and cleaning of the G29

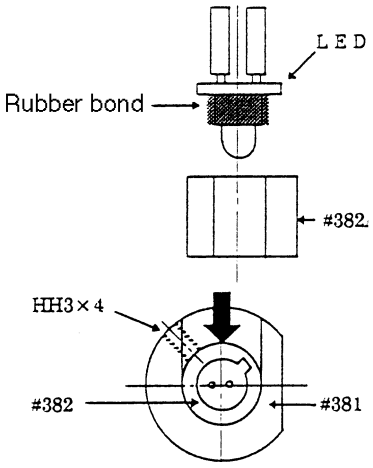
Replacement part: 32906-EA40




**<Replacing the LED for the Alignment>**

1. **Remove the Left, Right and Inner covers and the frame. (See § 5.)**

2. **Loosen HH3 × 4 and replace the LED for the Alignment.**
   * Fit the LED into #382 with a rubber bond. Take care not to tighten the screw (HH3 × 4) too much. If not, the LED may be damaged.

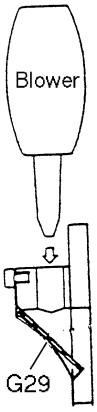



**<Blowing the dust on G29 off>**

When replacing the LED, G29 may get dirty. Check the G29 for dusts and clean it if necessary, following the procedure below.

1. **Turn ON the Power switch and look at the chart through the measuring window. If the dirt is seen within the field of view, blow the dust off the G29.**

   * The optical system was designed so that a person whose sphere powers are around - 2D can see the surface of G29 in focus. If one can not see the surface of the G29 clearly, wear correction lenses.



# 10.6 Replacing the Front cover

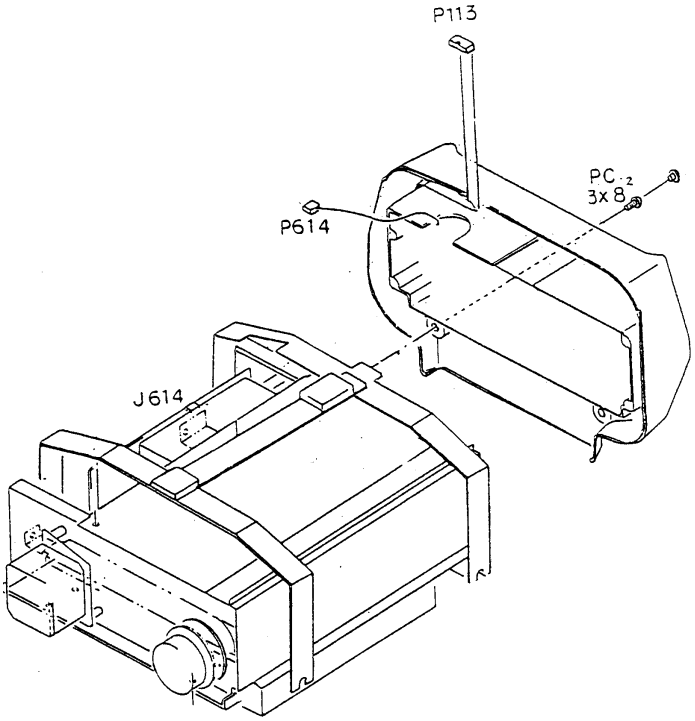
Replace the Front cover if the anterior segment lamp is faulty.

Replacement parts:

| AR-600 | AR series except AR-600 |
|---|---|
| 32906-6200 | 32907-6200 |

1. **Remove the Left, Right and Front covers. (See 5.1.)**

2. **Replace the Front cover with a new one.**



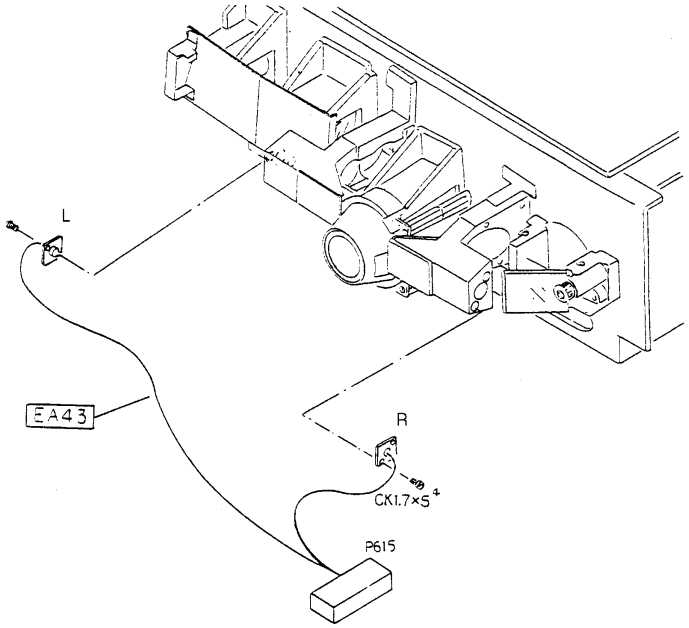
# 10.7 Replacing the FOCUS LED

Replacement part: 32907-EA43

1. **Remove the Left, Right and Front covers . (See 5.1.)**

2. **Unscrew CK1.7 × 5 (n=4) and replace the FOCUS LED with a new one.**

3. **Perform the auto-tracking and auto-shot calibrations.**
   * Return the cables to their original positions and arrange them so that they will not interfere with optical parts.

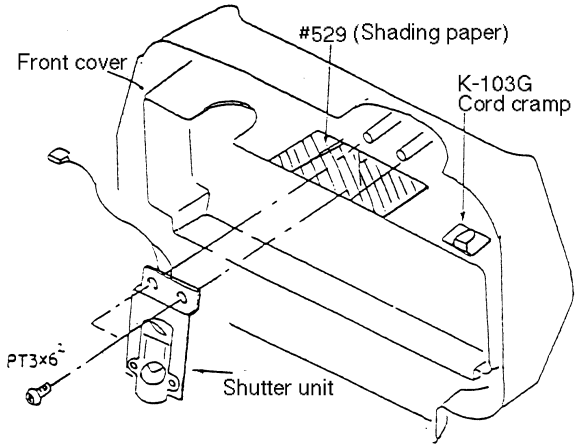


# 10.8 Replacing the Shutter

Replacement part: 32906-M542 (Moltopren)

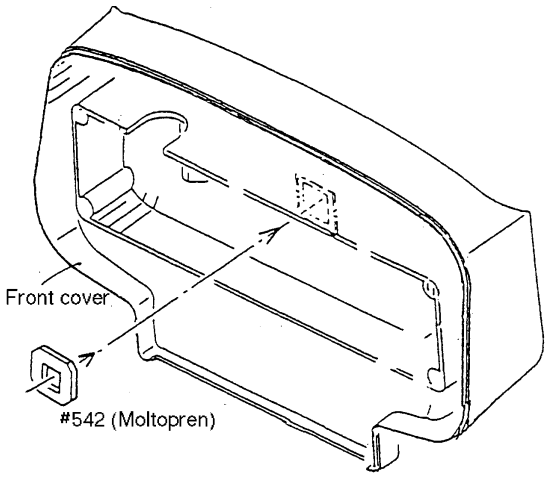
**1. Remove the Left, Right and Front covers. (See 5.1.)**

**2. Remove a shading paper (#529) from the Front cover.**
* A shading paper is cemented to the front cover with a double-sided tape.
Pay attention not to tear it as it will be used again.

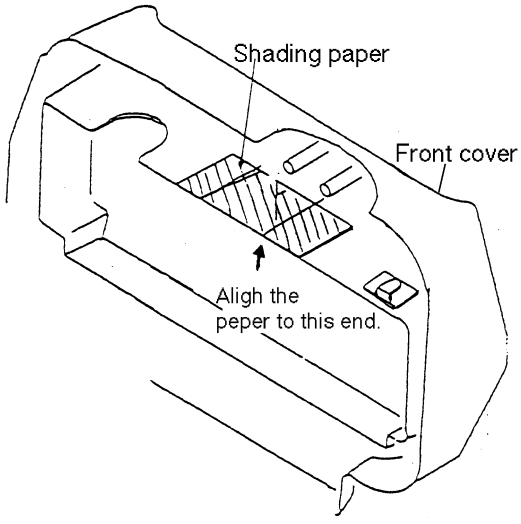



**3. Unscrew 3 × 6 (n=2). Take the shutter unit away from the front cover.**

**4. Stick the #542 on the inside the measuring window.**
* Check to see that the whole Moltopren is not shifted from the frame of the window.

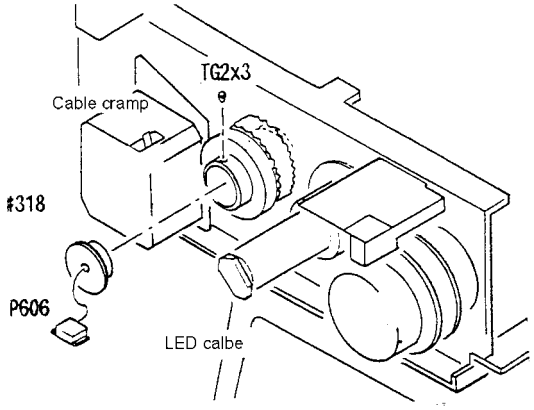



**5. Affix the shading paper to its original position with a double-sided adhesive tape.**

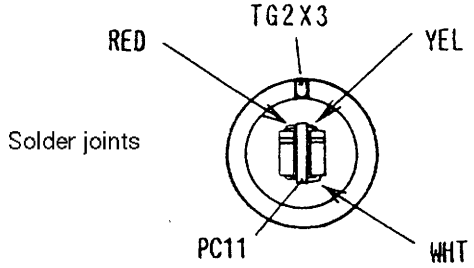


# 10.9 Replacing the LED cable

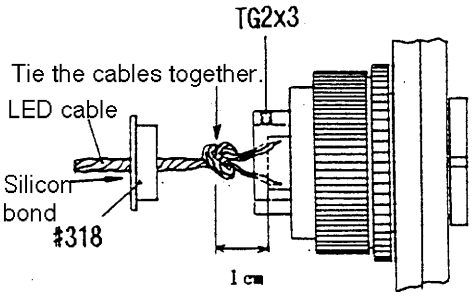
Replacement part : 32903-E5033




1. **Remove the Left, Right covers and Rear cover of the measuring unit. (See § 5.)**
2. **Disconnect the connector P606 and release the tied cables. (See 9.5.)**
3. **Loosen the screw (TG2 × 3), pull out #318 and cut the cables off.**




4. **Unsolder the cut-off cables on the PC11.**




5. **Pass the new cables through #318 and solder each cable to the PC11 board as shown in the figure.**
6. **Knot three cables inside #318 so that a force is not directly applied to the soldered joints.**
7. **Apply a drop of the silicone bond to the cable for the protection from breakage.**
   * Leave the cable for one half day or more until the bond becomes stiff. Confirm that the cable does not allow a slight movement even though the rotator is turned.
8. **Clamp the cable with a cable clamp so that it will not catch the moving rotator.**

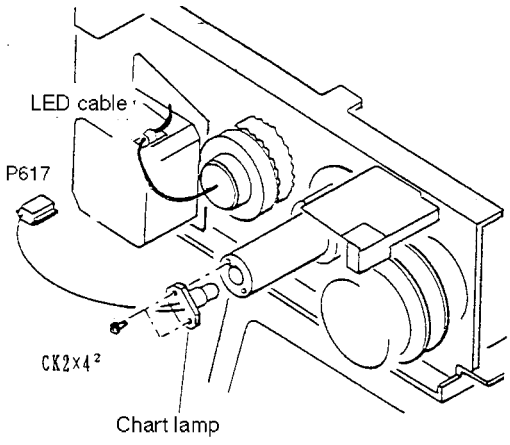
# 10.10 Replacing the Chart lamp

Replacement parts: 32906-EA14

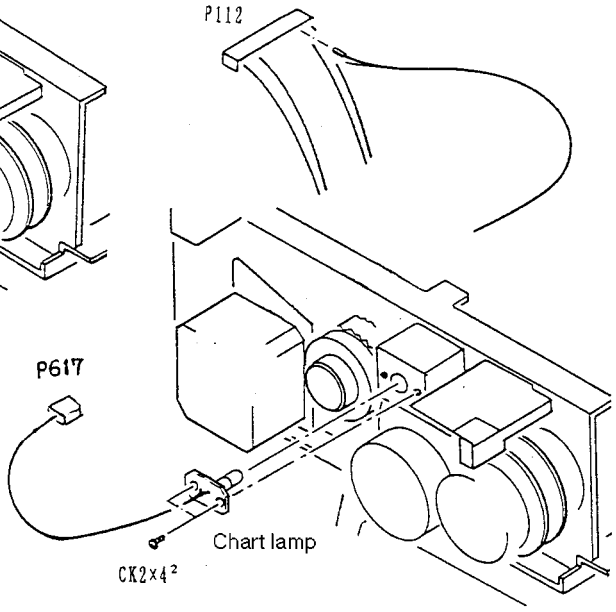
1. **Remove the Left, Right covers and Rear cover of the measuring unit. (See § 5.)**

2. **Unscrew CK2 × 4 (n=2) and replace the Chart lamp with a new one.**
   * Arrange the Chart cable so that it will not interfere with the LED cable.

<AR-600, AR-600A, ARK-700, ARK-700A>




<AR-660A, ARK-760A>



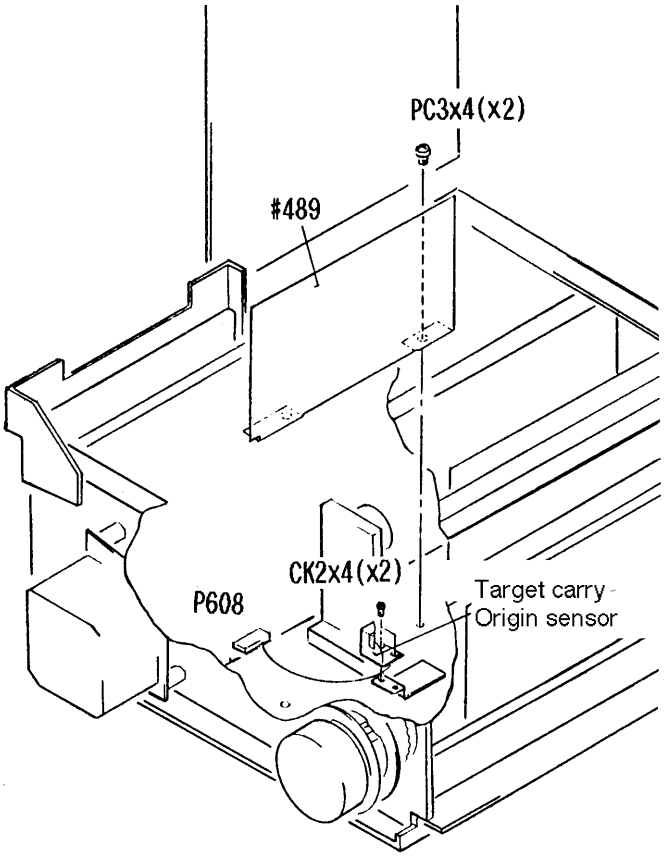
# 10.11 Replacing the Chart carry origin sensor

Replacement parts: 32906-EA36

1. **Remove the Left cover, Rear cover of the measuring unit and Inner cover. (See § 5.)**

2. **Remove the screw (PC3 × 4) and #489.**

3. **Unscrew CK2 × 4 and replace the Chart carry Origin sensor with a new one.**
   * Fix the sensor so that it will not interfere with the shutter of the Chart carry unit. Pay attention to cable arrangement. They should not interfere with the Carry unit and pulley.



# 10.12 Replacing the Rotator unit origin sensor

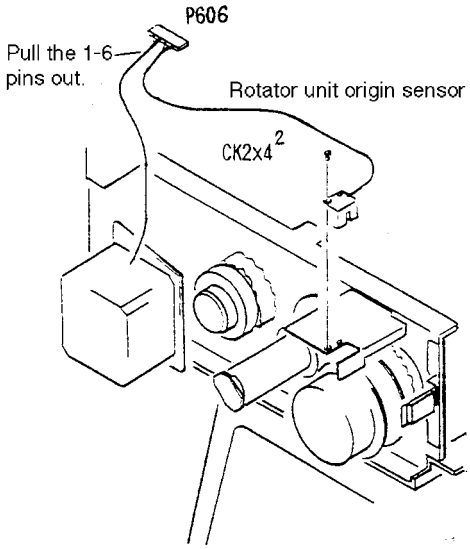
Replacement parts: 32903-E5045

**1. Remove the Left and Right covers. (See § 5.1.)**

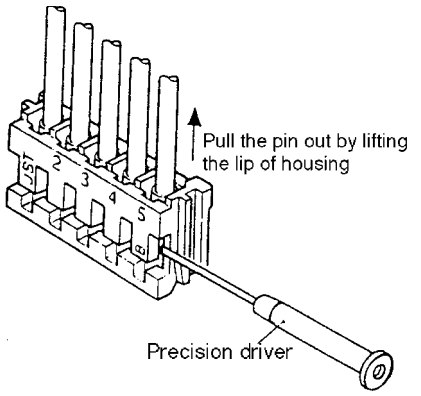
**2. Disconnect the connector (P606) and then pull the contact pin (1 - 6 pins) from the connector housing of the connector, and release the tie of the cables.**

**3. Unscrew PC2 × 4 (n=2) and replace the Rotator unit origin sensor with a new one.**

* See the following for the pins' position of the connector P606. Be careful not to return the pin to a wrong position.




| | | |
|---|---|---|
| 1 | YELLOW | Rotator P.M. |
| 2 | WHITE | |
| 3 | BLACK | |
| 4 | RED | |
| 5 | GREEN | |
| 6 | BLUE | |
| 7 | BROWN | Rotator origin |
| 8 | RED | |
| 9 | ORANGE | |
| 10 | YELLOW | |



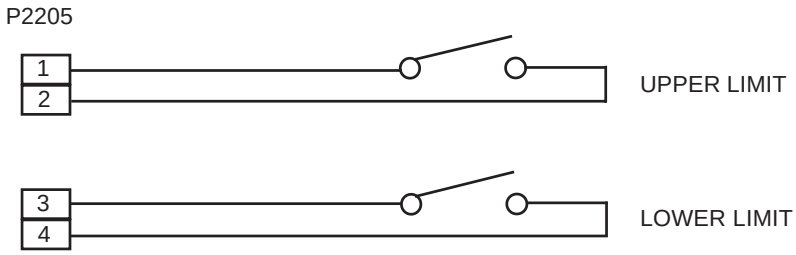

* Note that the cable from the Rotator unit origin sensor should not interfere with the LED cable.

# 10.13 Replacing U/D limit switches

**<Checking the operation of U/D limit switch>**

1. **Remove the Left, Right, Inner covers and rear cover of the measuring unit. (See § 5.)**

2. **Check the upper and lower limit switches for proper operation.**
   **Disconnect the connector (P2205) and check the continuity in the switches with a multimeter.**



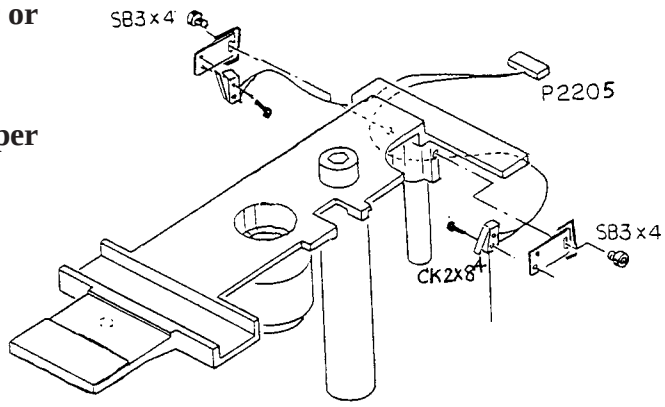

* Press an actuator with a screwdriver. The above shows the position of the Upper and Lower limit switches.

**<Replacing U/D limit switches>**

Replacement parts: 32097-EA47

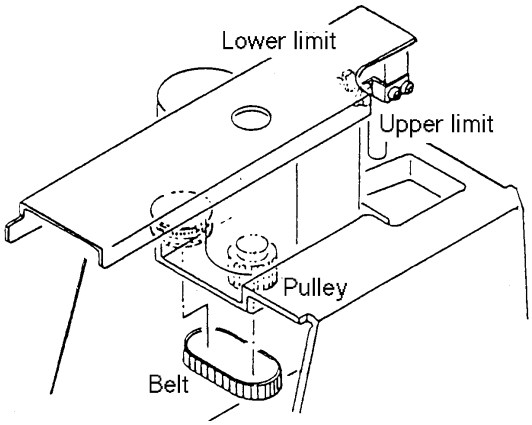
1. **Unscrew SB3 × 4 and take off the Upper or Lower limit switch.**

2. **Unscrew CK2 × 8 (n=4) to replace the Upper or Lower limit switch with new ones.**



**<Positioning Upper and Lower limit switches>**

1. **Remove the TV panel, Rear cover and Monitor. (See § 5 and 10. 17.)**
   * Keep the Pulleys in a state where they can be moved easily and directly by hand. To achieve the state, it is recommended to remove the belt.




2. **While moving up and down the measuring unit, loosen the screw (SB3 × 4) and position the Upper limit switch so that it conducts at the position where the pulley is returned one and a half turn from its mechanical limit with hands.**

3. **While moving up and down the measuring unit, loosen the screw (SB3 × 4) and position the Lower limit switch so that it conducts at the position where the pulley is returned a half-turn from its mechanical limit.**

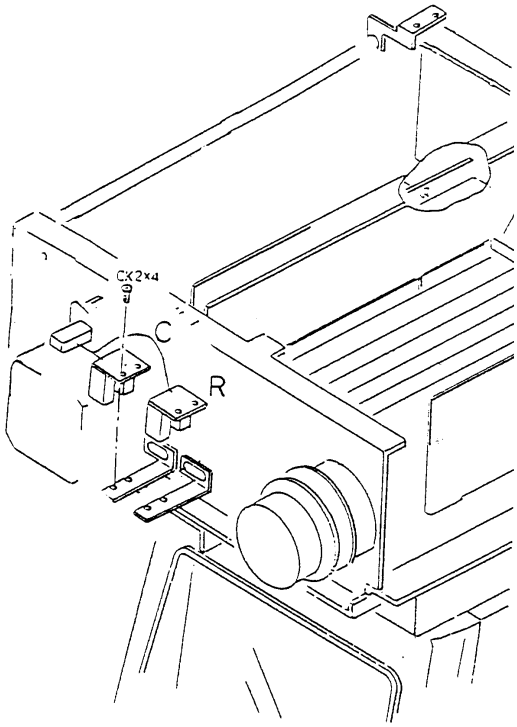
# 10.14 Replacing the Left and Right limit sensor unit (except for AR-600 and ARK-700)

Replacement parts: 32907-EA49

1. **Remove the Left, Right covers, Frame and the Rear cover of the measuring unit. (See § 5.)**

2. **Remove the connector and screw (CK2 × 4). Then replace the Left and Right limit sensor unit with a new one.**
   * Three sensors are included in the early models as the Left and Right limit sensor unit, but one of the sensors attached on the left is not activated.

   * The sensor R - Connected to 1-4 pin of P2207
     The sensor C - Connected to 5-8 pin of P2207




<Checking if the horizontal travel of the Main body is 6mm>

1. **Set Switch 4 of switchpack to the ON position.**

2. **Press and place the instrument in the "TRC ADJUST MODE 31".**

3. **Press and move the measuring unit to the right or left.**

4. **Verify that the horizontal travel between the left limit and the right limit of the measuring unit is 6 ± 1mm. (Draw lines of the right and the left limit position measured with the shading plate on the measuring base.**
   If it is not 6 ± 1mm, adjust the fixed positions of sensors.

5. **Press . The measuring unit will moves to its center. (Draw lines of the center position measured with the shading plate. Remember to draw lines of both the center measured from the left limit and the one measured from the right limit.)**

6. **Take a measurement of the distance between the lines. Then verify that the distance between the center position and each limit is 2mm or more.**
   * A displacement between the center positions measured in step 5 should be within 1mm.

# 10.15 Replacing the U/D Motor (for moving the measurement unit up and down) (Except AR-600)

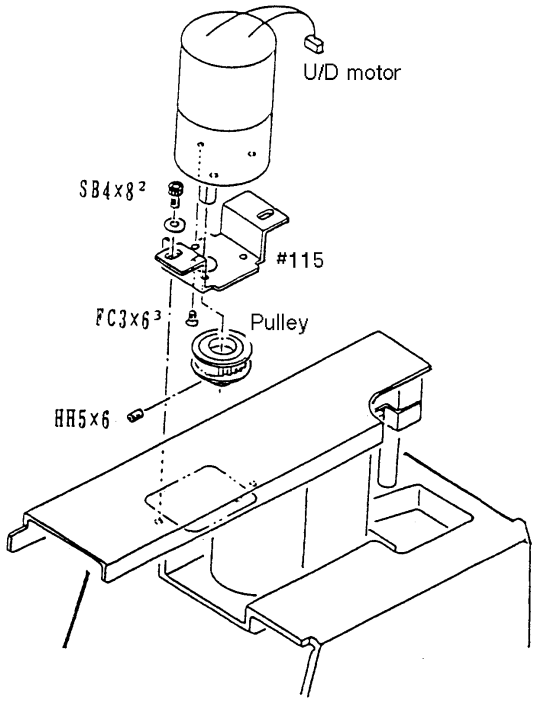
Replacement parts: For ARK-700 32156-EA05 For ARK-600A, ARK-700A, AR-660A, ARK-760A 39047-EA46

1. **Remove the Left, Right and Front covers, Rear covers of the measuring unit, Inner cover and TV panel. (See § 5.)**

2. **Remove the Monitor and measuring unit. (See 10.17 and 10.23.)**

3. **Unscrew SB4 × 8 and take the U/D motor away.**

4. **Remove the screw (HH5 × 6), Pulley, three screws (FC3× 6) and #115 and then replace the U/D motor with a new one.**
   * Adjust the belt tension so that it sags 4- 5mm when it is pressed down lightly with hands.



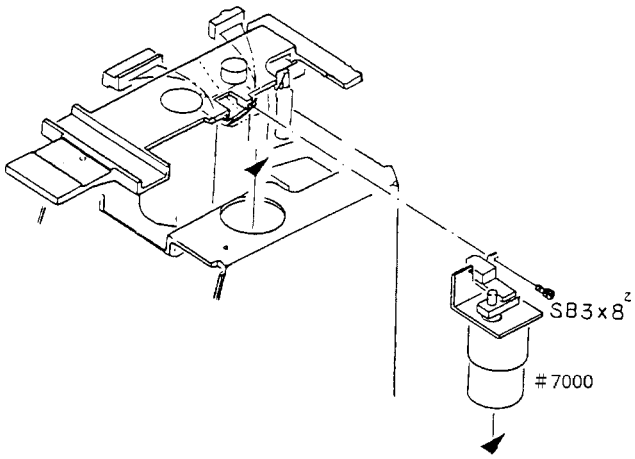
# 10.16 Replacing the R/L motor (For moving the instrument to the right or left) (Except AR- 600 and ARK-700)

Replacement part : 32907-EA48

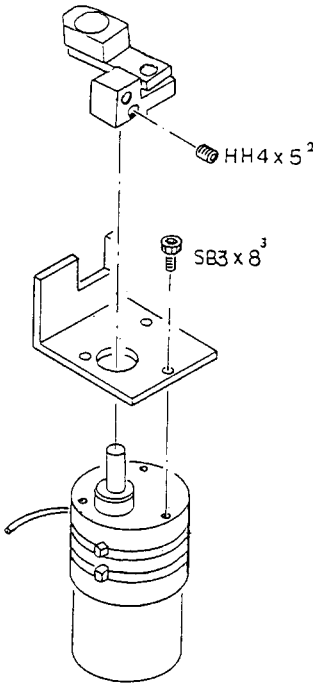
1. **Remove the Left, Right and Front covers, Rear cover of the measuring unit, Inner cover and TV panel. (See § 5.)**

2. **Remove the Monitor and measuring unit. (See 10.17 and 10.23.)**

3. **Unscrew SB3 × 8 (n=2) and take off #7000.**




4. **Unscrew HH4 × 5 (n=2) and SB3 × 8) and replace the motor with a new one.**



# 10.17 Replacing the TV Monitor

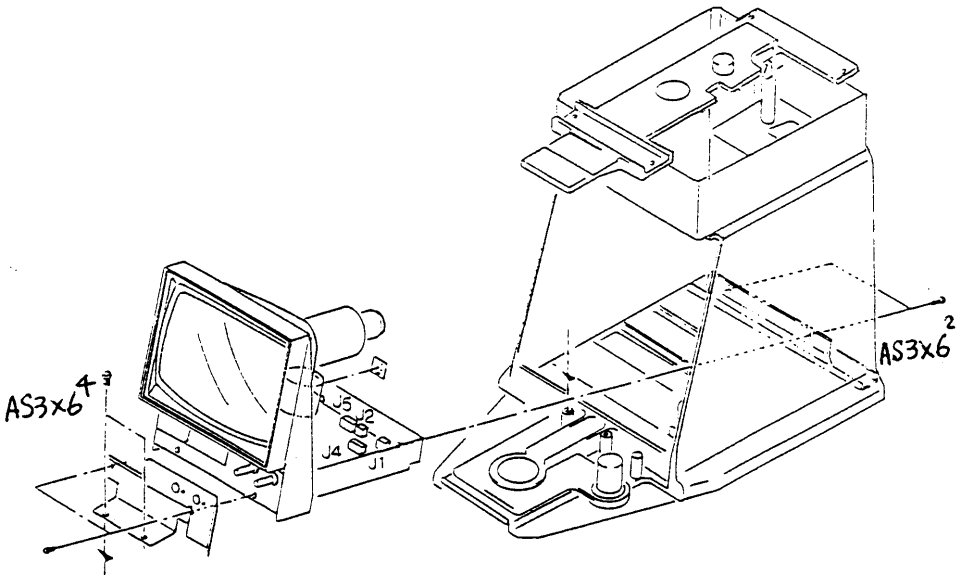
Replacement parts: 32903-E001B

1. **Remove the Rear cover and TV panel.**
   **(See § 5.)**

2. **Disconnect the connectors.**

3. **Remove the screws (AS3 × 6) and #176 and replace the TV monitor with a new one.**
   * The Joystick may obstruct the replacement work. It is possible to bring the TV monitor toward the Joystick by removing the bottom cover.

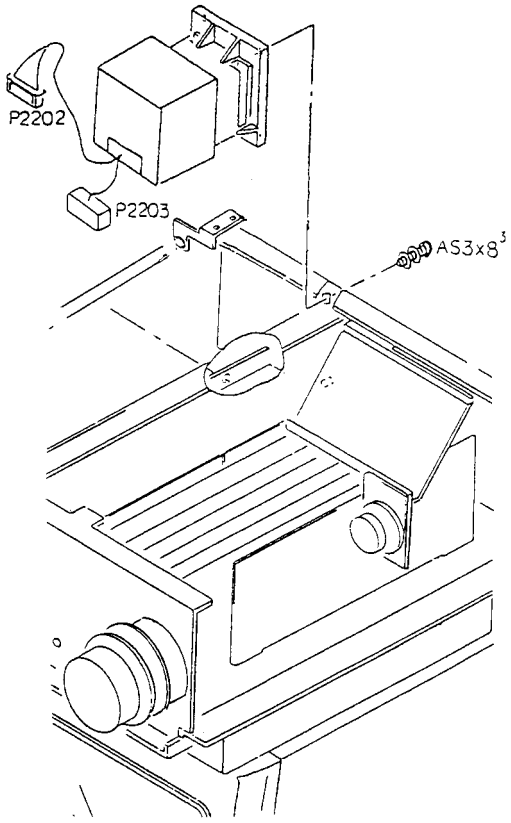
   * Image centering may be slightly shifted. The shift can be corrected with H.V volume. If it can not be corrected completely, it is necessary to perform image centering. (See 11.9.)




4. **Fit the parts in reverse order.**
   * P004 can be connected to either J1 (VIDEO IN) or J2 (VIDEO OUT).

# 10.18 Replacing the CCD camera

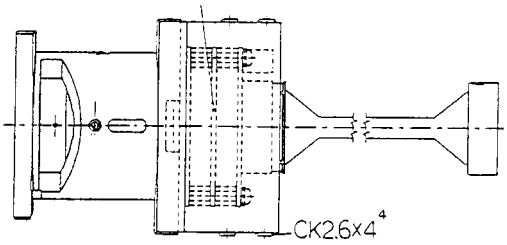
Replacement parts: 32903-E001A




1. **Remove the Left, Right covers, Rear cover of the measuring unit and Inner cover. (See § 5.)**

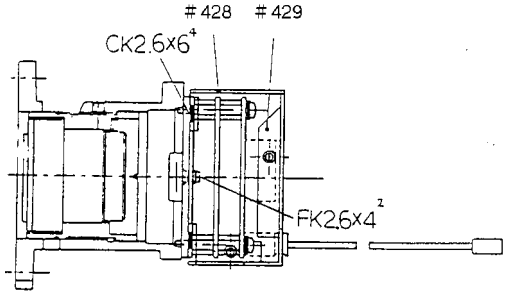
2. **Disconnect the connectors.**
   * For AR-600, disconnect P004 only.

3. **Unscrew AS3 × 8 (n=3) and replace the CCD camera with a new one.**




4. **Unscrew CK2.6 × 4 (n=4) and then remove CCD camera, #428 and #429.**

5. **Unscrew FC 2.6 × 4 and replace CCD camera with a new one.**




6. **Turn ON the Power switch and verify hat the target square is in focus. If it is out of focus, adjust the lens focus of the CCD camera.**
   * The image centering may be slightly shifted. If the centering cannot be achieved perfectly by adjusting the variable resistor on PC6 board, adjust the focus of the CCD camera lens. (See 11.9.)

# 10.19 Replacing the Chart unit

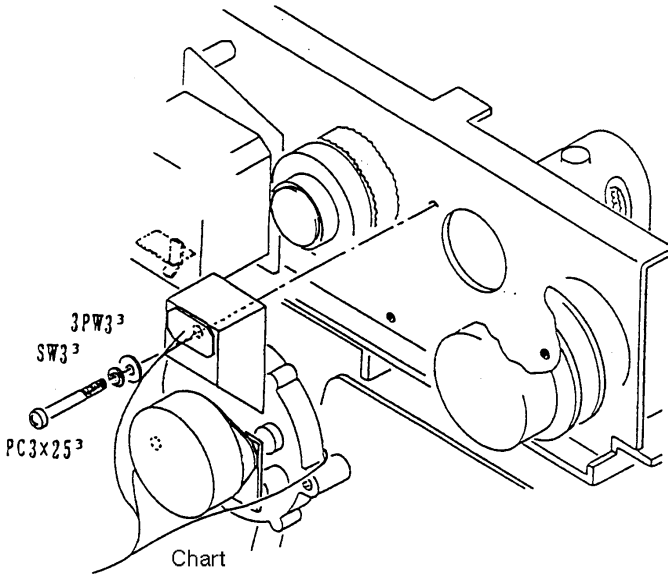
Replacement parts: 32908-3150

**1. Remove the Left and Right covers and the Rear cover of the measuring unit (See § 5.)**

**2. Disconnect the connectors.**

**3. Unscrew PC3 × 25 (n=3) and replace the chart unit with a new one.**

* Though the replacement part is stored in a plastic bag to keep dust out, check to see that no dust settles on the part before attaching it.
Attach the unit temporally, then turn ON the Power. Adjust the inclination of the chart unit so that the chart can be seen on a perfectly-horizontal plane.



# 10.20 Replacing CYL unit (Only for AR-660A and ARK-760A)

Replacement parts: 32908-3160

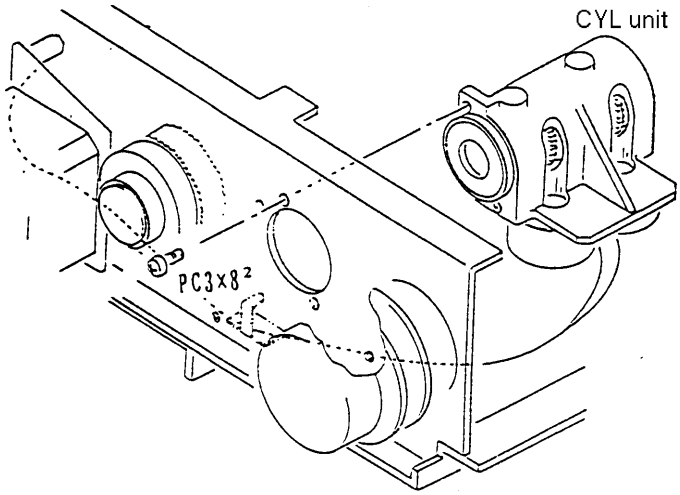
1. **Remove the Left and Right covers and Rear cover of the measuring unit, and Inner cover. (See § 5.)**

2. **Take the shading plate out.**

3. **Remove the Chart unit.**
   * Do not remove the connectors but remove the screws and position the chart unit so that it will not obstacle the replacement work for CYL unit. Check to see that no dust settles on the part before attaching it. Pay attention not to touch the unit when routing the cables.

4. **Remove the connectors P610 and P611.**

5. **Unscrew PC3 × 8 (n=2) and replace the CYL unit with a new one.**
   * Though the replacement part is stored in a plastic bag to keep dust out, check to see that no dust settles on the part before attaching it.
   Pay attention to the arrangement of the cables.




6. **Set CYL zero (C1) and CYL axis (C2) to the specified values. (See 11.8.10.)**
   * Set them to the component values specified on the note which is attached to the replacement part.

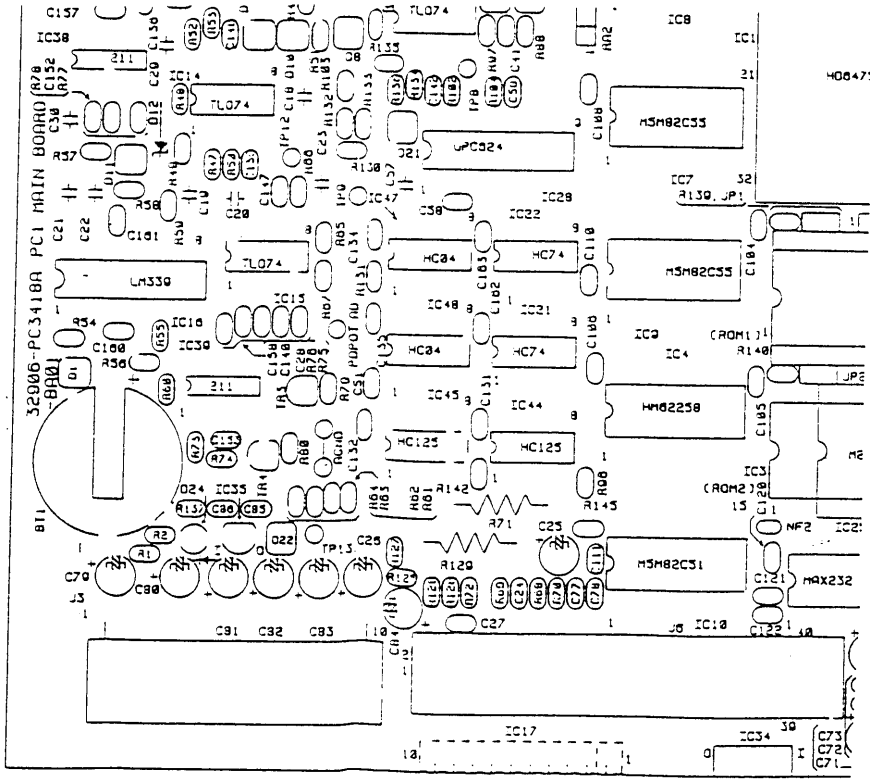
# 10.21 Replacing the Battery

Replacement parts: 32906-E651

**1. Remove the Left and Right covers and Rear cover of the measuring unit, and Inner cover. (See § 5.)**

**2. Stand the PC1 board.**

**3. Replace the battery with a new one.**
* Observe the correct polarity for BT1.



# 10.22 Replacing the Measuring unit

**<For AR-600 and ARK-700>**

| | AR-600 | AR-700 |
|---|---|---|
| Replacement parts: | 32906-9000 | 32158-9000 |

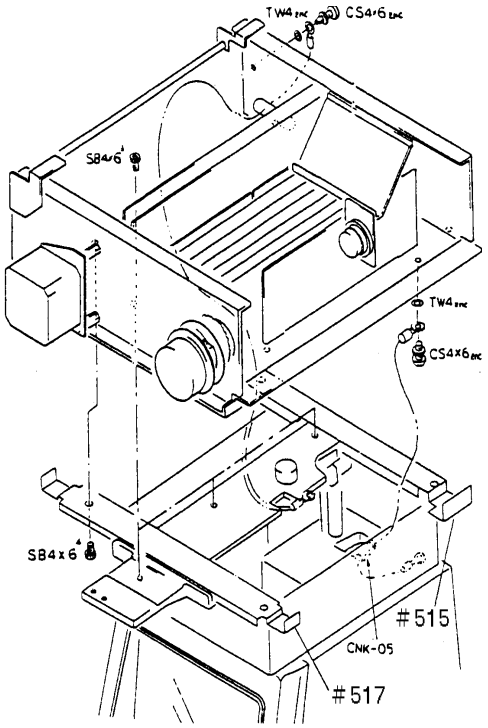
**1. Remove the Left, Right covers, the Rear cover of the measuring unit and Inner cover. (See § 5.)**

**2. Disconnect the connectors on PC1 board.**

**3. Remove the screws (CS4 × 6[2]) and grounding wires.**

**4. Remove the screws (SB4 × 6[4]), #515 and #517, and replace the measuring unit with a new one.**

* The measuring unit should be transported with its covers attached for keeping dust out. Therefore, for returning the unit for service and etc, be sure to pack the measuring unit with its covers attached.
* For the early models, replace #515 and #517 together with the measuring unit. This is because that the holes' positions for #515 and #517 differs from the ones for the other models.




**5. Set the parameters according to parameter tables on Operator's Manual.**

**<For AR-600A, AR-660A, ARK-700A and ARK-760A>**

| Replacement parts: | For AR-600A | For ARK-660A | ARK-700A | ARK-760A |
|---|---|---|---|---|
| | 32907-9000 | 32908-9000 | 32159-9000 | 32160-9000 |

**1. Remove the Left, Right and Front, Rear covers of the measuring unit, Inner cover and TV panel. (See § 5.)**

**2. Disconnect the connectors.**

**3. Unscrew CS4 × 6 (n=2) and take off grounding wires.**

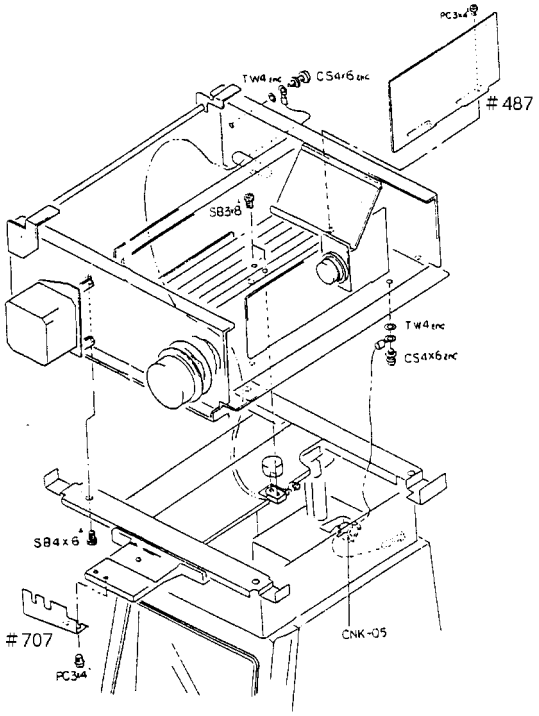
**4. Unscrew PC3 × 4 (n=3) and take off #107.**

**5. Unscrew PC3 × 4 (n=3) and take off #487.**

**6. Unscrew SB3 × 8 (n=3) and SB4 × 6 (n=4) and replace the measuring unit with a new one.**

* The measuring unit should be transported with its covers attached for keeping dust out. Therefore, to return the unit for service and etc, be sure to pack the measuring unit with its covers attached.

* For the early models, replace #515 and #517 together with the measuring unit. This is because that the holes' positions for #515 and #517 differs from the ones for the other models.

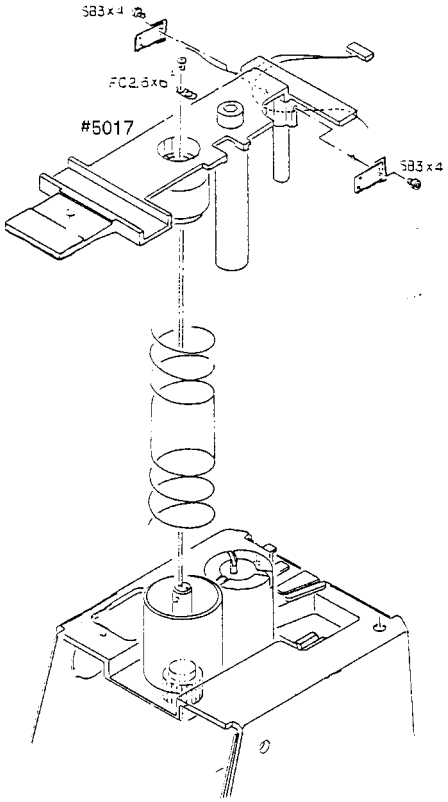



**7. Set the parameters according to parameter tables on Operator's Manual.**

# 11.1 Adjusting the pressure of roller bearing (#67) for up-and-down shaft

If the roller bearings become loose due to shock delivered during transportation and the measuring unit becomes unstable, adjust the pressure of the bearings, following the procedure below.

Replacement parts (Shaft) : 34322-M066
(Eccentric shaft) : 34322-M067
(Roller bearings) : 82011-0410A




1. **Turn ON the Power switch and verify that all three bearings are turning when moving up and down the measuring unit. If not, follow the steps below.**

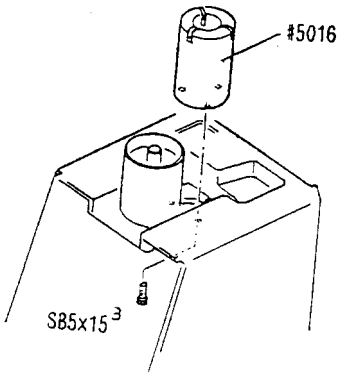
2. **Take the measuring unit off. (See 10.22.)**

3. **Remove the screws (PC4 × 6) and #84.**

4. **Unscrew FC2.6 × 5, take off #76 and #5017.**
   * Take off #5017 by turning the Joystick while holding down #5017.
   Pay attention not to spring #5017 away as it is pressed upward by the spring.

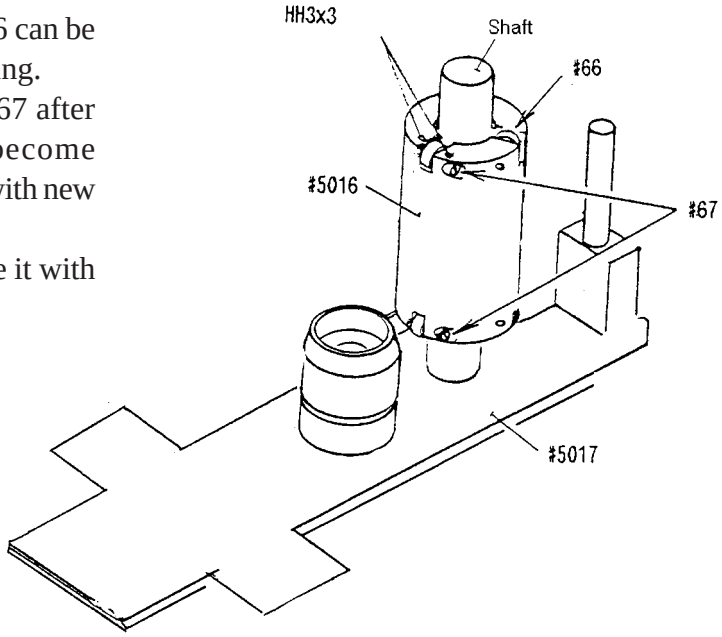
5. **Take off the TV monitor. (See 10.18.)**

**6. Unscrew SB5 × 15 and then take off #5016.**




**7. Fit #5016 on the Shaft of #5017, loosen HH3 × 3 and adjust #66 so that the Shaft moves up and down smoothly and it is stable.**

* Since #67 has a slot on its head, #66 can be turned with a screwdriver for adjusting.
* If there is still a too much play in #67 after adjusting it, #66 and #67 may become warped. In such cases, replace them with new ones.
* If the bearing has cracks in it, replace it with a new one.



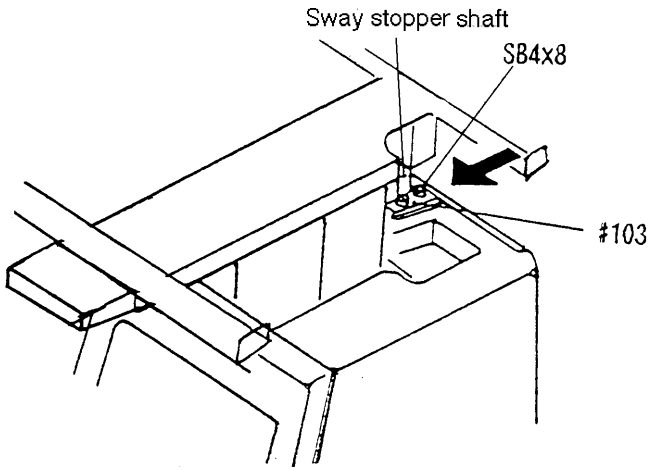
# 11.2 Adjusting the Sway stopper unit

If there is too much play in the Sway stopper unit due to shock delivered during transportation, and the measuring unit sways when laterally-turned, adjust the sway stopper unit, following the procedure below.

1. **Lock the main body and take the measuring unit off. (See 10.22.)**
   * It is not necessary to remove the PC1 board, CCD camera and Front cover.

2. **Take off #84. (See 11.1.)**

3. **Loosen the screw (SB4 × 8) and position #103 until there is no play in the Sway stopper unit.**
   * Take care not to tighten the screws (SB4 × 8) too much. The measuring unit may not be moved up and down.
   * If the applied grease dried out, the lateral movement of the measuring unit become worse. In such cases, apply the grease to the Sway stopper shaft.

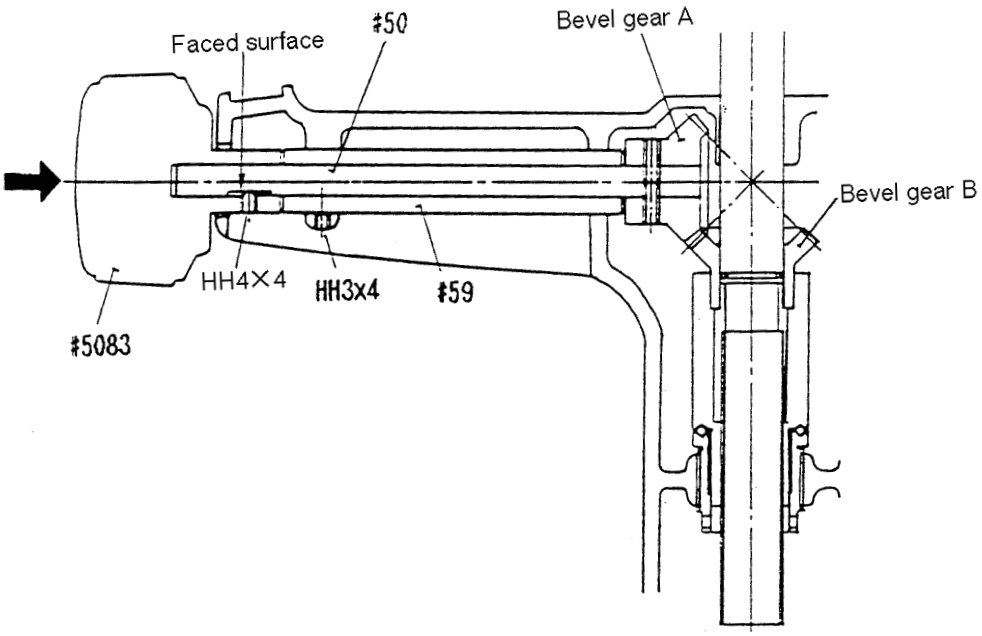


# 11.3 Adjusting the up-and-down movement of the Chin rest

If the Chin rest knob become loose, it may drop with chin's weight when placing chin on the rest. In such cases, adjust the Chin rest knob, following the procedure below.

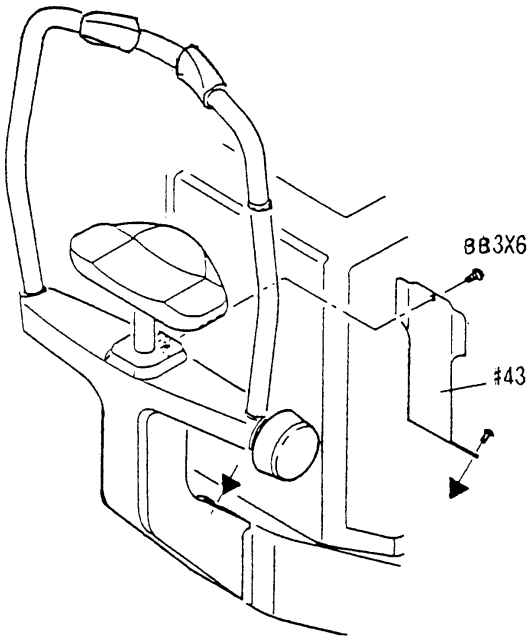
1. **Loosen HH3 × 4 fixing #59 and HH4 × 4 fixing #5083.**
   **Then tighten the screw (HH4 × 4) while pressing the Chin rest knob toward the arrow direction.**
   * Tighten HH4 × 4 so that it touches the faced surface of #50.

2. **Adjust the Chin rest knob properly. Insure proper fit between the Bevel gear A and B. Then tighten HH3 × 4 to fix #59.**



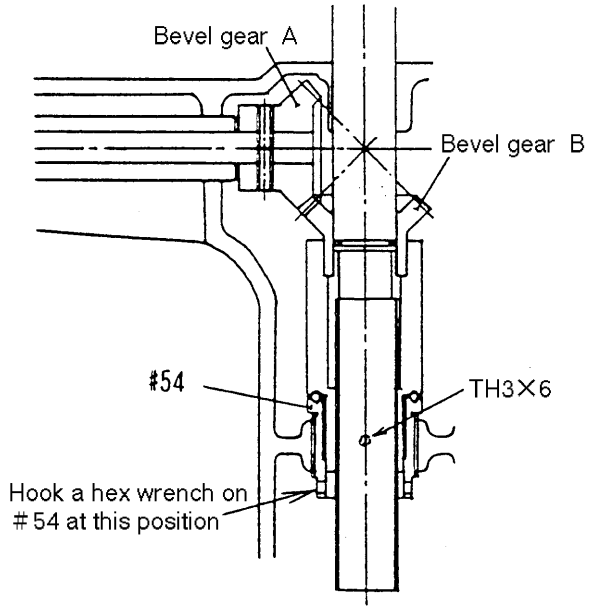
If the proper movement of the Chin rest cannot be achieved by adjusting the Knob, it is necessary to adjust the height of the Bevel gear B. In such cases, follow the procedures below.

**3. Unscrew BB3 × 6 and take #43 off.**




**4. Loosen TH3 × 6 and turn #54. Adjust the height of the Bevel gear B and a fit between the Bevel gears A and B.**

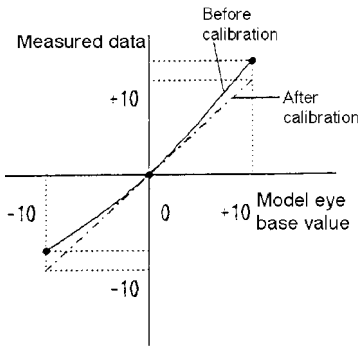
* Hook the hex wrench on #54 and turn it with the wrench.



# 11.4 Calibrating by adjusting the focus of CCD camera lens

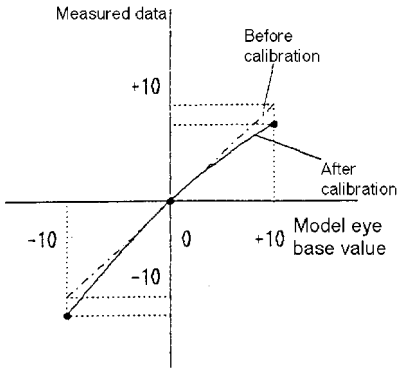
When calibration can not be achieved properly by adjusting the variable resistors on the PC6 board, it is necessary to perform calibration by adjusting the focus of CCD camera lens.

1. **Measure the Model eye of 0D and verify that the obtained data equals to the model eye base value. If not, adjust VR2 (S.ZERO) on the PC6 board. (See 11.7.1.)**




2. **Measure the model eyes of − 10D and + 10D. Check the difference between the obtained data and Model eye base value.**

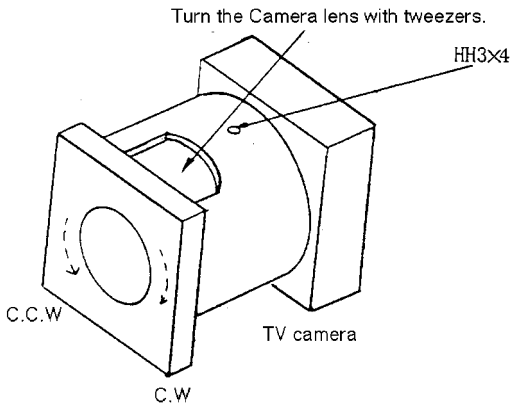
3. **If all the data obtained by measuring model eyes of any diopter is higher than the calibration value as shown on the right graph, turn the CCD camera lens clockwise.**




4. **If all the data obtained by measuring model eye of any diopter is lower than the calibration value as shown on the right graph, turn the CCD camera lens counterclockwise.**

5. **Adjust the TV camera lens properly so that the data distribution forms a straight line on the graph. Adjust GAIN (gradient) on VR1 (S. GAIN) on the PC6 board. (See 11.6.)**

6. **Tighten the screw (HH3 × 4) after the adjustment work of camera lens.**



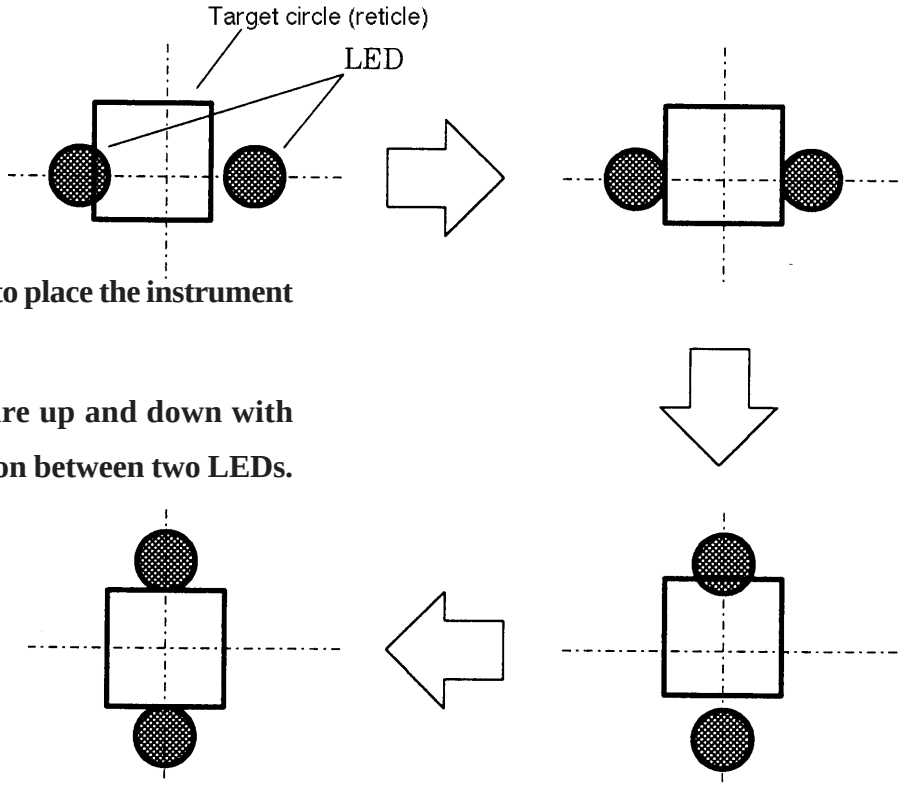
# 11.5 Positioning the target

1. **Set Switch 4 of the switchpack to the ON position.**

2. **Press and place the instrument in the OTHER ADJUST MODE 10-0.**

3. **Align the frame of the model eyes to the measuring point and adjust the focus of two measurement light LEDs.**

4. **Move the target square to the right and left with and to position it between two LEDs.**




5. **Turn the Rotator 90º.**

6. **Press the Start button to place the instrument in the MODE 10-2.**

7. **Move the target square up and down with ▲ and ▼ to position between two LEDs.**

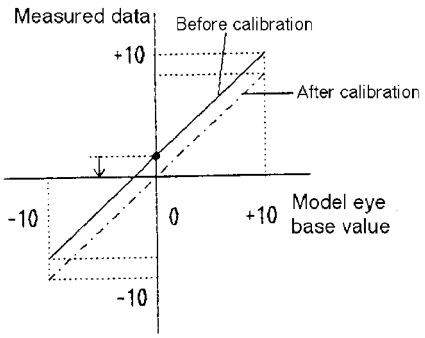
# 11.6 Sensor calibration (adjusting VR1 and VR2 on the PC6 board)

If only the obtained SPH data is abnormal after replacing the PC6 board, perform sensor calibration by adjusting VR1 and VR2 on the PC6 board. However, the calibration work should be performed only in conditions where sensor OFFSET is normal and the focus of the camera lens are achieved properly.
If CYL data is too high and SPH data is abnormal due to other reasons, correct the erroneous state first. If not, the measured data may be unreliable instead.

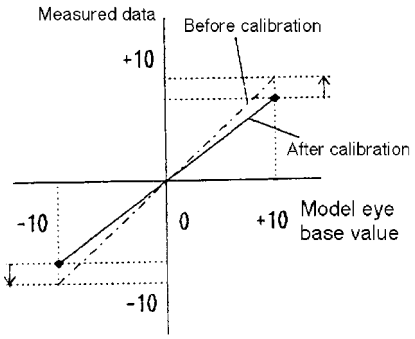
1. **Remove the Left and Right covers (See 5.1.)**

2. **Attach the Model eyes (three steel balls) to the Forehead rest and turn ON the Power Switch (See 4.3).**

3. **Adjust the VR2 (S.ZERO) on the PC6 board so that the measured data of 0D model eye (the center one) equals to its base value.**




4. **Adjust the VR1 (S.GAIN) on the PC6 board so that the measured data of ＋ and － 10D model eyes (the left and right ones) equal to their base value.**



**<Adjusting SPH correction range>**

**1. Set Switch 4 of the switchpack to the ON position.**

**2. Press and place the instrument into the AR ADJUST MODE 0.**

**Procedure for correcting - SPH range**
**<For AR-600 series>**

**1. Press while holding down CYL. → SPH power decreases.**

**2. Press while holding down CYL. → SPH power increases.**

**Procedure for correcting + SPH range**
**<For AR-600 series>**

**1. Press while holding down . → SPH power decreases.**

**2. Press while holding down . → SPH power increases.**

**Procedure for correcting - SPH range**
**<For ARK-700 series>**

**1. Press while holding down . → SPH power decreases.**

**2. Press while holding down . → SPH power increases.**

**Procedure for correcting + SPH range**
**<For AR-700 series>**

**1. Press while holding down CYL. → SPH power decreases.**

**2. Press while holding down CYL. → SPH power increases.**

# 11.7 KM auto-calibration (only for ARK-700 series)

1. **Set the Model eyes to the Forehead Rest.**
   Clean the steel balls and measuring window before calibration.

2. **Turn the Power switch ON.**

3. **Set Switch 4 of the switchpack to the ON position. Press (R/K) to place the instrument in the KM calibration mode.**

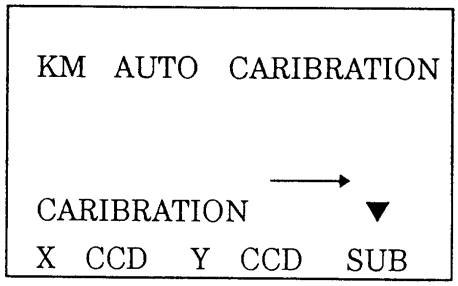
4. **Press (▼). The display as shown on the right figure appears.**

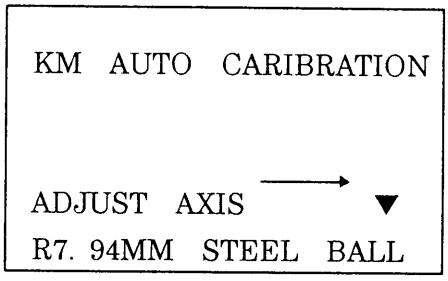
5. **Align the steel ball of R7.94mm to the center of the TV monitor and then press the Start button. KM measurement will take place 10 times in a row automatically. The display on the right figure appears.**

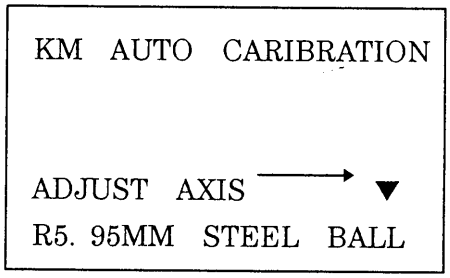
6. **Align the steel ball of R5.95mm to the center of the TV monitor and then press the Start button. KM measurement will take place 10 times in a row automati cally. The display on the right figure appears.**

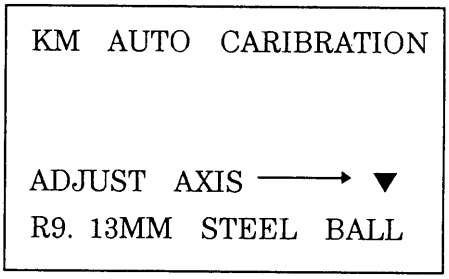
7. **Align the steel ball of R9.13mm to the center of the TV monitor and then press the Start button. KM measurement will take place 10 times in a row automatically. The display on the right figure appears.**

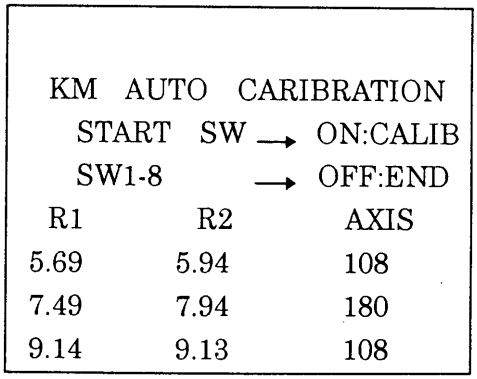
8. **Verify that the measurement results are within the following tolerances.**
   R1 →± 0.02mm
   R2 →± 0.02mm



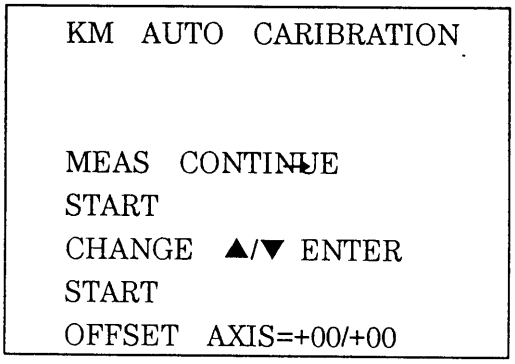



9. **If the measurement results are out of the tolerances, check to see that the steel ball is aligned precisely to the center of the TV monitor and perform auto-calibration again.**

10. **If the desired results cannot be obtained by repeating the calibration several times, it is necessary to adjust the optical axis for KM measurement again.**

11. **Set Switch 4 of the switchpack to the OFF position.**



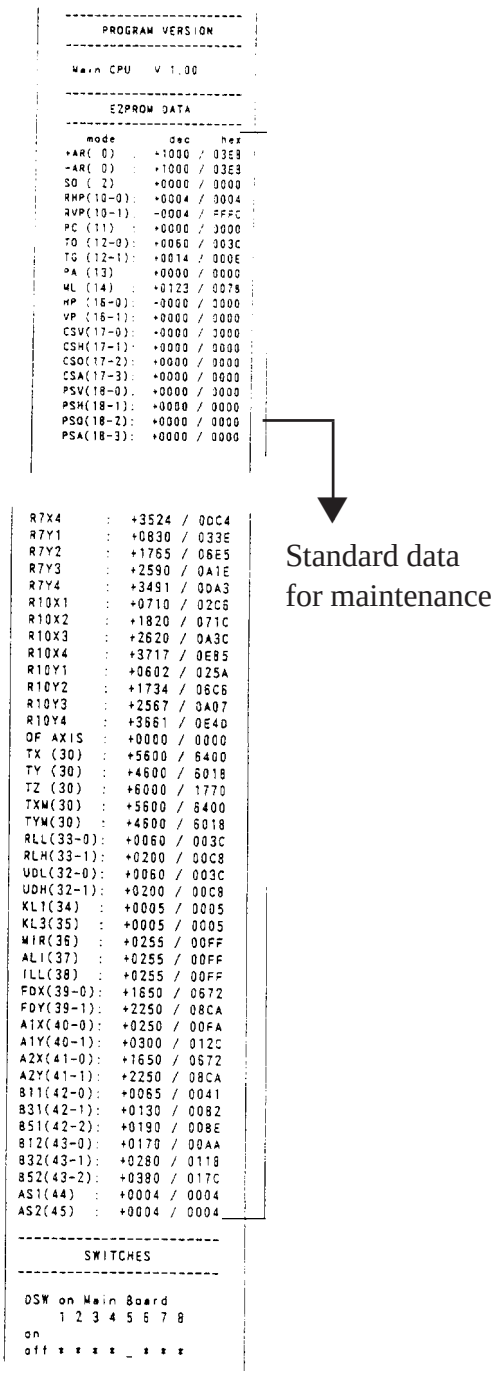
# 11.8 Setting EEPROM DATA

If EEPROM DATA is cleared, inquire of NIDEK or your authorized distributor about DATA and set EEPROM DATA following the procedure below.

* Regardless of no erroneous condition on the circuit, there are cases where EEPROM DATA is cleared and only “MEMORY FAILURE ON EEPROM” is printed out one time instead of EEPROM DATA (due to noises). In such cases the message will not be printed out any further.
  If the message is printed out, it is certainthat EEPROM DATA will be cleared. To checkif the DATA is cleared, turn ON and the Power switch. If the DATA is cleared, all the items in the DATA will become zero.

* There are variations in the values of EEPROM DATA from instrument to instrument.

  All the items in the DATA will be memorized by setting SW3 of switchpack 1 on the PC1 board to the OFF position. Print out the DATA once to check it.
* The DATA will be stored in any MODE (MODE 10-20) by setting Switch 3 to the OFF position.




Standard data for maintenance

# 11.8.1 Setting Sensor Offset (SO)

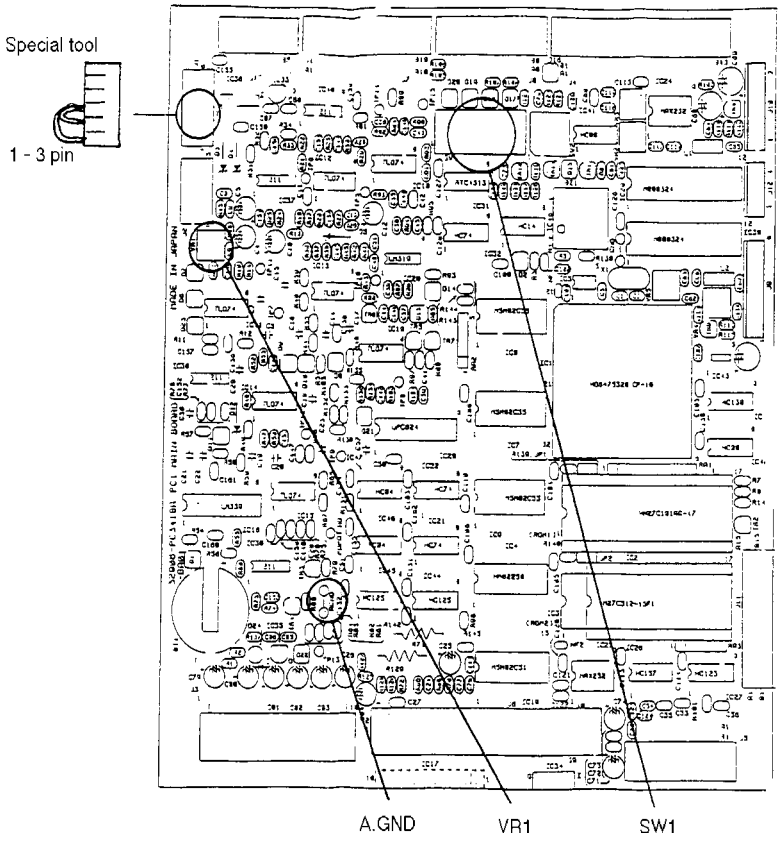
1. **Disconnect the P101 connector. Connect the special tool between 1 and 3 pins, 2 and 3 pins to short-circuit the 1, 2, and 3 pins of the J1 connector on the PC1 board. Then turn the Power switch ON.**

2. **Set Switch 4 of the switchpack1 to the ON position and press the start button twice to place the instrument in "MODE 2" (See § 12.)**

3. **Connect a digital multimeter between TP12 and A. GND on the PC1 board and verify that the reading is 0V. If not, adjust VR1 on the PC1 board.**

4. **Press both and PD button simultaneously.**

5. **Set Switch 4 of the switchpack 1 to the OFF position. The sensor offset data will be stored.**
   * Since the stored SO data is operated by CPU, it is not always equal to the factory-shipped data.

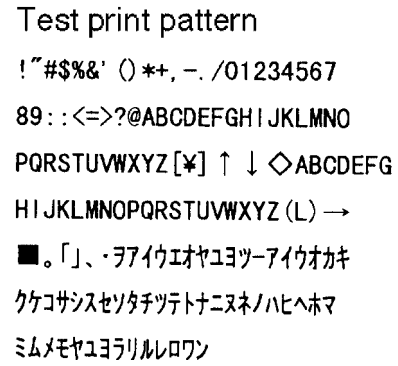


## 11.8.2 Setting Print Density (PC)

1. **Turn ON the Power switch.**

2. **Set Switch 3 of the switchpack 1 on the PC1 board to the ON position. The instrument will be placed in "MODE 10".**

3. **Change the value with ▲ and ▼ (the value changes in －1.00 - ＋1.00 range in 1 increments) and print out the data with R/K to check the printout for density.**

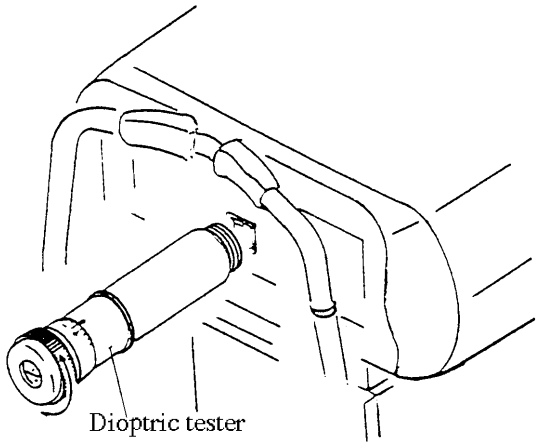



   * Normally set the data to "000". Setting a positive value will slow down the printing speed and increase the print density. Setting the value higher than needed may affect life of the printer head.

4. **Change the mode to "MODE11" for the next adjustment. Hold down the Start button for three sec. and release it. The mode will change to "MODE 11".**

## 11.8.3 Setting Target Offset (TO)

1. **Set the value as you inquired with PD button or in "MODE 11".**
   * The deterioration of the dial string may cause the 0D to be shifted. If you have a dioptric tester, look at the chart through a dioptric tester and check to see that the chart is in correct focus (Be sure to adjust the dioptric tester to your visibility). If the chart is out of focus, adjust the focus properly. In such cases, the focus should be the point when the sharp focus is obtained first while changing the value from positive side.




2. **Change the mode to "MODE12" for the next adjustment. Press the Start button. The mode will change to "MODE 12".**

## 11.8.4 Setting Target Gain (TG)

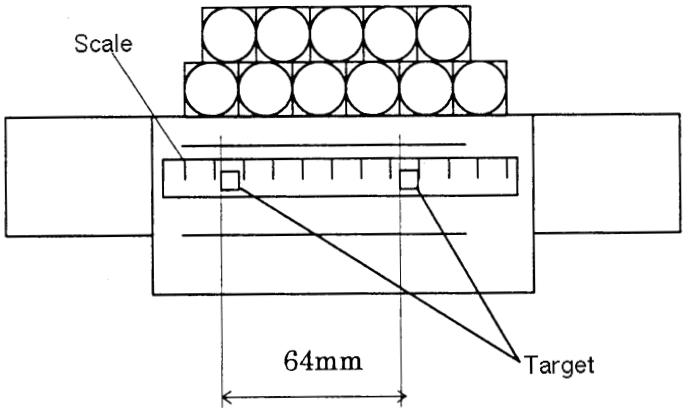
1. **Set the value as you inquired with PD button or in "MODE 12".**
   * Most instruments have their values (indication value) set to "1.03".
     The printed data will be "(DEC) + 0015".

2. **Change the mode to "MODE14" for the next adjustment. The mode will change to "MODE14" by additionally pressing the start button for three sec. and releasing it.**
   * The target gain does not change as it is controlled by a pulse motor. The target calibration can be checked in "MODE 13", which is only subordinate function.

## 11.8.5 Setting PD Gain (PA)

1. **Press the Start button to place the instrument in “MODE 13”.**

2. **Stick a scale on the Model eye with a plastic tape and calibrate the PD value to 64mm.**




3. **Align the target to the standard line of the scale.**

4. **Slide the main body by 64mm to the right, align the target to the scale and then press** (Start)**.**

5. **Check that “64” appears. If not, adjust the value to 64 with** (▲) **and** (▼)**.**

6. **Change the mode to “MODE 15” for the next adjustment.**

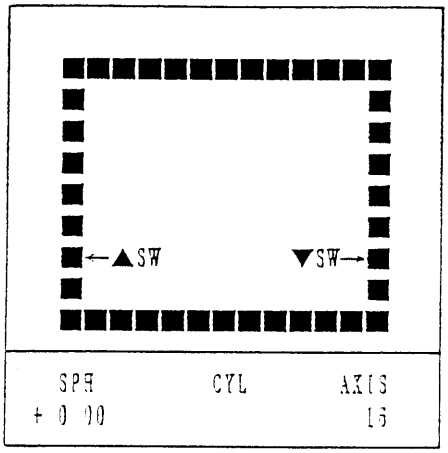
## 11.8.6 Setting Mask Blink Level (ML)

1. **Set the value to ＋123 (1.8V) with** (▲) **and** (▼) **in “MODE 15”.**

## 11.8.7 Setting Horizontal Position (HP) of display

1. **Place the instrument in "MODE 16-0" with the Start button.**

2. **Adjust the horizontal position of the display with (▲) and (▼).**

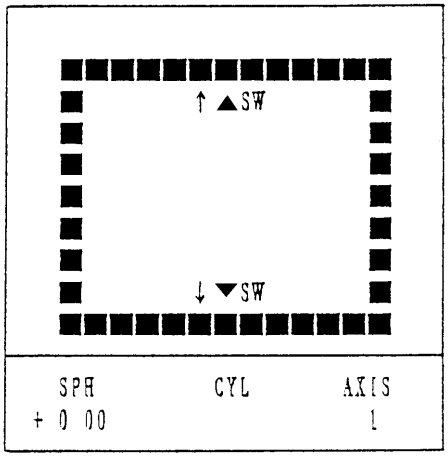



## 11.8.8 Setting Vertical Position (VP) of display

1. **Place the instrument in "MODE 16-0" with the Start button.**

2. **Adjust the vertical position of the display.**

3. **Revert the system to MODE 16-0 with (CYL).**
   * Check to see that the display is positioned as shown in the right figure.



# 11.8.9 Adjusting scale for CS (Corneal Size) measurement (only for ARK-700 series)

1. **Place the instrument in "MODE 17-0" with the Start button.**

2. **Adjust the vertical position of the fiducial line and guide line with and ▼.**

3. **Change the mode to "MODE 17-1" with the Start button.**

4. **Adjust the vertical position of the fiducial line and guide line with and ▼.**

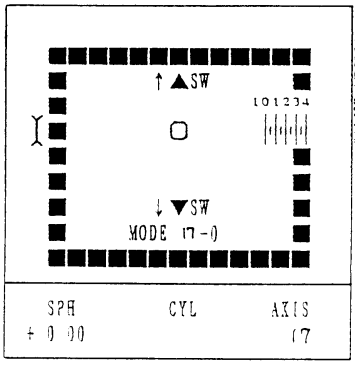
5. **Change the mode to "MODE 17-2" with the Start button.**

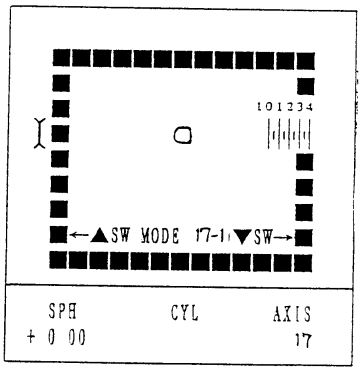
6. **Move the guide line to the left or right with ▲ and ▼, and position it 12mm to the fiducial line right so that the 12mm of the guide line is aligned with 12mm of the guide line eye.**

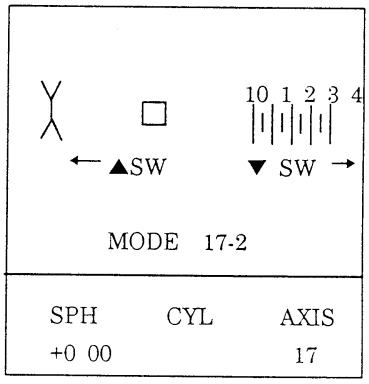
7. **Change the mode to "MODE 17-3" with the Start button.**

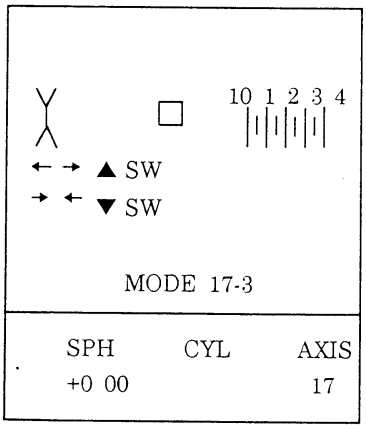
8. **Change spacings between scales of the guide line with ▲ and ▼, and align the 10 - 14mm scales with the ones of the model eye scale.**

9. **Return the mode to "MODE 17-0" with CYL.**



<Adjusting CS>

1. Place the instrument in “MODE 18-0” with the Start button.

2. Adjust the vertical position of the fiducial line and guide line with (▲) and (▼).

3. Change the mode to “MODE 18-1” with the Start button.

4. Adjust the vertical position of the fiducial line and guide line with (▲) and (▼).

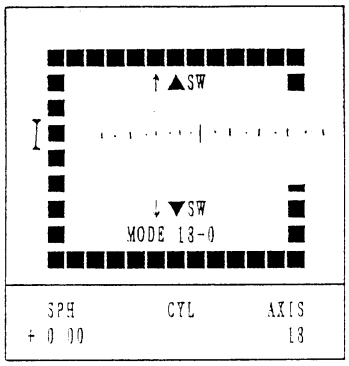
5. Change the mode to “MODE 18-2” with the Start button.

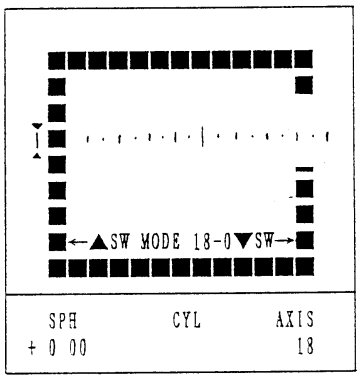
6. Move the guide line to the left or right with (▲) and (▼), and position it 5mm to the fiducial line right so that the 5mm scale of the guide line is aligned with the one of the model eye scale.

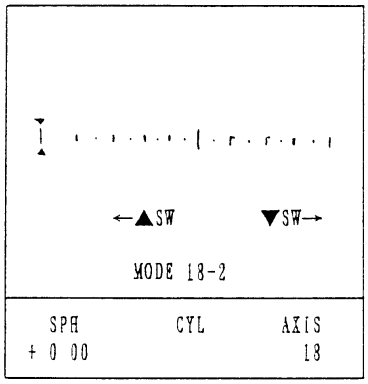
7. Change the mode to “MODE 18-3” with the Start button.

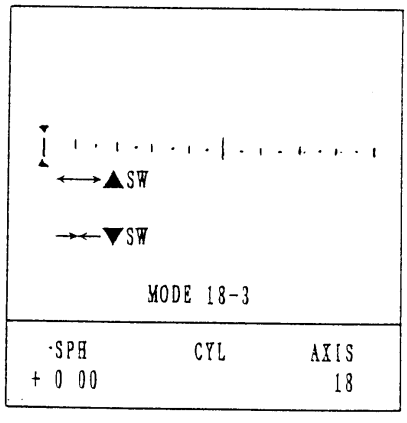
8. Change spacings between scales of the guide line with (▲) and (▼), and align the 1 - 10mm scales with the ones of the model eye scale.

9. Return the mode to “MODE 18-0” with (CYL).



# 11. 8. 10 Setting CYL zero (C1) and CYL axis (C2) (Only for AR-660A and ARK-760)

1. **Set Switch 4 of the switchpack 1 on the PC1 board to the ON position and press to place the instrument in the CYL lens mode.**

2. **Set the CYL axis (C2) value to the specified one in "MODE 61".**

3. **Set the CYL zero (C1) value to the specified one in "MODE 60".**

4. **Set Switch 4 of the switchpack 1 to the OFF position.**

   * The value changes in 10 increments with ▲ or ▼ while pressing ✥.

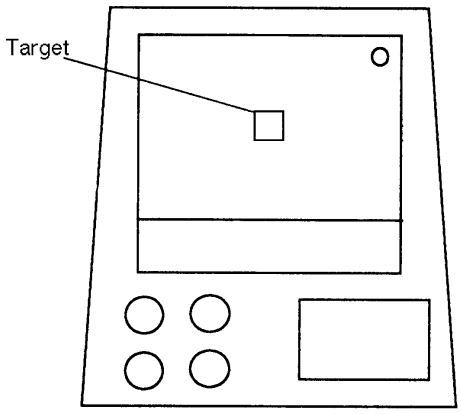
   The presented chart can be switched with ▭ and ☯.

   Axis can be changed in 90° increments with A.

# 11.9 Adjusting image centering

When replacing CCD camera or TV monitor with new ones, the image centering may be slightly shifted. It is possible to adjust it with H.V. volume. However, if it can not be adjusted properly, follow the procedures below to perform the centering.

1. **Position the target on the center of the display with H.V. volume to adjust the image centering.**



# 11.10 Adjusting Brightness and Sharpness of display

1. **Connect the connector P602 of the LED to J2 on the PC6 board.**

2. **Connect the oscilloscope as follows.**

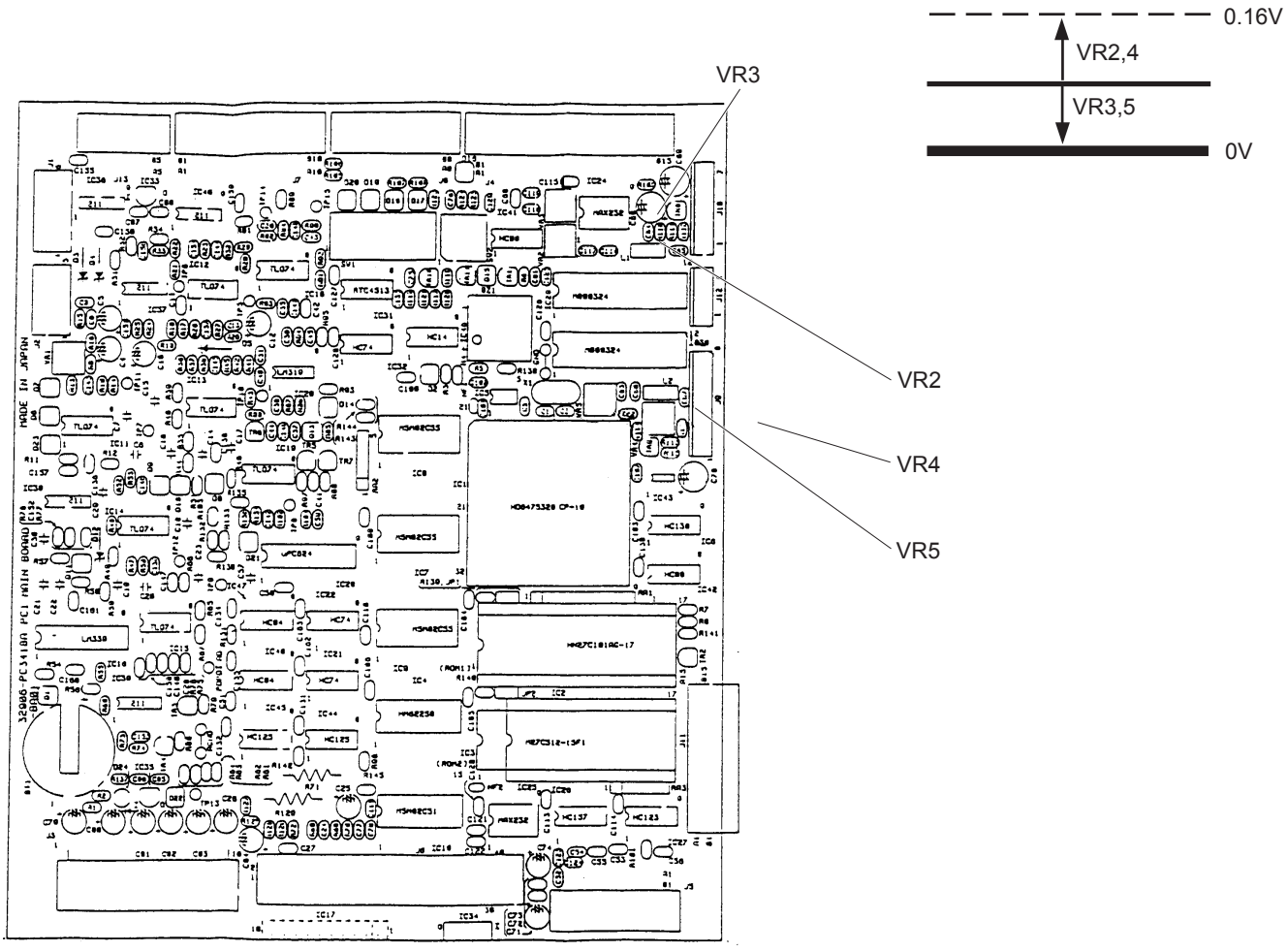
| | | |
|---|---|---|
| CH1 | Probe | to soldered surface of J12 on the PC1 board |
| CH1 | alligator clip | to ANALOG GND on the PC1 board |
| TIME | 5 μs/DIV | |
| VOLTS | 0.1V/DIV AC | |

3. **Turn ON the Power switch while holding down (A). For AR-600 and ARK-700, set Switch 7 to the ON position and then turn ON the Power switch.**

4. **Adjust each value as follows.**

For adjusting letters VR2 (Brightness): 0.16V VR3 (Sharpness): 0V

For adjusting the target VR2 (Brightness): 0.16V VR5 (Sharpness): 0V



# 11.11 Tracking auto-calibration (except AR-600 and ARK-700)

1. **Set Switch 4 to the ON position. Or press the Power switch while holding down (CYL) and to place the instrument in TRC ADJUST MODE.**

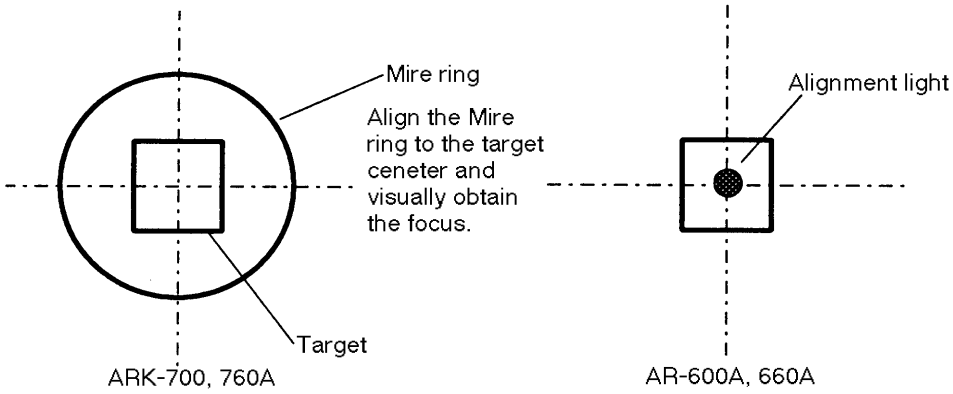
2. **Set Switch 6 to the ON position.**

3. **Set the Model eye to the Forehead rest.**

4. **Place the instrument in "MODE 30".**

5. **Press (⇔) to make "30" appear at the left end of the Display panel.**

6. **For ARK-700A and ARK-760A, align the Mire ring to the center of the target and adjust the focus properly. For AR-600A and AR-660A, align the Alignment light to the center of the target and adjust the focus properly. Then press (A).**



8. **Press the Start button once and place the instrument in "MODE 31".**
   * Hereafter the MODE No. will be switched to another No. with every press of the Start button.

9. **Press (◉) and check to see that th measuring unit will move to the right limit.**

10. **Press (◉) and check to see that the measuring unit will move to the left limit.**

11. **Press (📏) and check to see that the measuring unit will move to the center limit.**
    * After checking that the measuring unit will stop at each limit properly, leave it at the center limit.

※

12. **Place the instrument in "MODE 32-0" and set the value to "55" with (▲) or (▼).**
    * Hereafter change the value with (▲) or (▼).

13. **Place the instrument in "MODE 32-1" and set the value to "170" with (▲) or (▼).**

14. **Place the instrument in "MODE 33-0" and set the value to "55" with (▲) or (▼).**

15. **Place the instrument in "MODE 33-1" and set the value to "170" with (▲) or (▼).**

16. **Place the instrument in "MODE 44" and set the value to "＋8" with (▲) or (▼).**

17. **Place the instrument in "MODE 45" and set the value to "＋2" with (▲) or (▼).**

18. **Revert the instrument to "MODE 31" and repeat the steps ※ to check the measuring unit for correct operation again.**
    * If the movement of the instrument is not smooth, fine-adjust the slide rail.

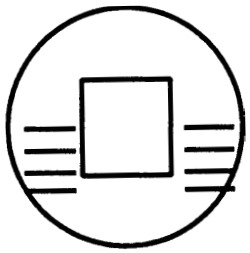
19. **Set Switch 4 to the OFF position.**
    **Or press both (CYL) and (⊖) simultaneously.**

**20. Press . will appear on the display.**

**21. Align the 0D model eye position to the measuring point.**

**22. Bring the Main body forward and then gradually adjust the focus.**

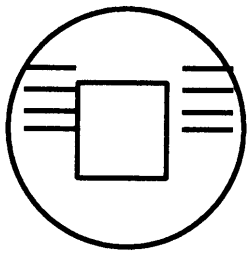
**23. Check to see that the instrument starts measurement automatically when the number of bars which are on both sides of the target decreases to one.**



(Measurement will take place.)

**24. If bars blink, it is possible that the light of the Mire ring (for ARK-700 series) or tracking light (For AR-600 series) may be coming out.**
**In such cases, block it with black lacquer.**

**25. Bring the Main body backward and gradually adjust the focus.**



**26. Check the number of bars when measurement automatically starts as in the step 24.**

**27. Perform the steps 23 - 27 with the ＋22D and ＋17D model eye to check the correct operation of the instrument.**

# §12 Program for adjustment

To the system into the adjustmnet mode, turn ON DS4 or press PON, (CYL) and (⇨).
Writing EEPROM data is possible while DSW4 is OFF. Or use (CYL) + (⇨) combinations to writing the data.

・AR ADJUST ((☯))

| MODE No. | Function | Remarks |
|---|---|---|
| 0 | AR adjustment: LED Off: Servo Off | "Prt" : Rotate TEST |
| | Correcting the compensation range (plus side) | "CL select" + "▲" : Addition of Compensation coefficient<br>"CL select" + "▼" : Subtraction of Compensation coefficient |
| | Correcting the compensation range (minus side) | "CL select" + "▲" : Addition of Compensation coefficient<br>"CL select" + "▼" : Subtraction of Compensation coefficient |
| 1 | AR adjustment: LED ON :Servo Off | "Prt" : Parameter setting (Japan) |
| | | "Change" : Parameter setting (N. INC) |
| | | "ILO" : Parameter setting (Overseas) |
| | | "CL select" : Moving sensor carry unit forcefully(0V) |
| 2 | AR adjustment: LED ON :Servo On | "Prt" & "Change" : SDIV adjust |
| | | "ILO" : Switching between SPD and DUMMY (The mode can be checked by the Print LED) |

Common operations: Start button...The mode will be changed to the next mode.
(⊙)..... The instrument revert to the Menu mode.

・OTHER ADJUST ((▭)) (AR models do not have adjustment mode 17 and 18.)

| MODE No. | Function | Remarks |
|---|---|---|
| 10 | Mode 0: Target Horizontal adjustment | Change the horizontal position with "▲" or "▼". |
| | Mode 1: Target vertical adjustment | Change the vertical position with "▲" or "▼".<br>Revert to "MODE 0" with (CYL) . |
| | Print density adjustment | Change the print density with "▲" or "▼". |
| 12 | Mode 0: Chart offset adjustment | Change offset value with "▲" or "▼". |
| | Mode 1: Chart gain adjustment | Change gain with "▲" or "▼". |
| | Mode 2: Chart position check | Switch the chart positions between 0D, -12D and +12D with(▤) .<br>The illumination will be turned ON and OFF with (◐) .<br>Revert to "MODE 0" with (CYL) . |
| 13 | Mode 0: PD center offset adjustment | Change offset value with "▲" or "▼". Obtain the offset value from the preset position (center) with (▤). |
| | Mode 1: PD gain adjustment | Measure a distance between two desired points with (▤) and set the indicated value to the obtained one with"▲" or "▼". Revert to "MODE 0" with (CYL) . |
| 14 | Mask Blink Level adjustment | Change the blink level "▲" or "▼". |
| 15 | Mask-LED Position check | Change the Rotator angle to 90° with (▤).<br>Change the Rotator angle to 0° or 180° with "▲" or "▼".<br>Change the Rotator angle to 45° or 135° with "▲" or "▼". |
| 16 | Mode 0: Display Horizontal adjustment | Change the horizontal position with "▲" or "▼". |
| | Mode 1:Display Vertical adjustment | Change the vertical position with "▲" or "▼". Revert to "MODE 0" with (CYL) . |
| 17 | Mode 0: CS screen Vertical adjustment | Change the vertical position with "▲" or "▼". |
| | Mode 1: CS screen Horizontal adjustment | Change the horizontal position with "▲" or "▼". Adjust the standard position. |
| | Mode 2: CS Scale 14mm adjustment | Adjust the CS Scale 14mm position with "▲" or "▼". |
| | Mode 3: CS Scale 10mm adjustment | Adjust the CS Scale 10mm position with "▲" or "▼". Revert to "MODE 0" with (CYL) . |
| 18 | Mode 0: PS screen Vertical adjustment | Change the vertical position with "▲" or "▼". |
| | Mode 1: PS screen Horizontal adjustment | Change the horizontal position with "▲" or "▼". Adjust the standard position. |
| | Mode 2: PS Scale 14mm adjustment | Adjust the PS Scale 14mm position with "▲" or "▼". |
| | Mode 3: PS Scale 10mm adjustment | Change the PS Scale 10mm position with "▲" or "▼". Revert to "MODE 0" with (CYL) . |

・TRC ADJUST (⊕) (only for A-type models)

| MODE No. | Function | Remarks |
|---|---|---|
| 30 | Auto-tracking position adjustment | Set the Auto-tracking position with Ⓐ. |
| 31 | R/L Center Limit adjustment | Information about each limit will be displayed on the TV monitor. |
| 32 | Mode 0: The smallest value at fine-run of R/L motor. | Change the minimum value with "▲" or "▼".<br>Switch between static image and line drawing with Ⓘ. |
| | Mode 1: The largest value at fine-run of R/L motor | Change the maximum value with "▲" or "▼".<br>Switch between static image and line drawing with Ⓘ.<br>Revert to "MODE 0" with ⓒYL. |
| 33 | Mode 0: The smallest value at fine-run of U/D motor. | Change the minimum value with "▲" or "▼". |
| | Mode 1: The largest value at fine-run of U/D motor. | Change the maximum value with "▲" or "▼".<br>Revert to "MODE 0" with ⓒYL. |
| 34 | KM1 LED (Left side) Level adjustment | Change the value with "▲" or "▼". |
| 35 | KM3 LED (Right side) Level adjustment | Change the value with "▲" or "▼". |
| 36 | MIRE LED Level adjustment | Change the value with "▲" or "▼". |
| 37 | ALIGN LED Level adjustment | Change the value with "▲" or "▼". |
| 38 | ILLUMI LED Level adjustment | Change the value with "▲" or "▼". |
| 39 | MODE 0: X axis focus indicator width | Change the value with "▲" or "▼". |
| | MODE 1: Y axis focus indicator width | Change the value with "▲" or "▼". Revert to "MODE 0" with ⓒYL. |
| 40 | MODE 0: X axis focus auto-shot range (for the first measurement) | Change the value with "▲" or "▼". |
| | MODE 2: Y axis focus auto-shot range (for the first measurement) | Change the value with "▲" or "▼". Revert to "MODE 0" with ⓒYL. |
| 41 | MODE 0: X axis auto-shot range (for the second measurement or later) | Change the value with "▲" or "▼". |
| | MODE 1: Y axis focus auto-shot range (for the second measurement of later) | Change the value with "▲" or "▼". Revert to "MODE 0" with ⓒYL. |
| 42 | MODE 0: The range in which one focus bar is indicated (for the first measurement) | Change the value with "▲" or "▼". |
| | MODE 1: The range in which three focus bars are indicated (for the first measurement) | Change the value with "▲" or "▼". |
| | MODE 2: The range in which five focus bars are indicated (for the first measurement) | Change the value with "▲" or "▼". Revert to "MODE 0" with ⓒYL. |
| 43 | MODE 0: The range in which one focus bar is indicated (For the second measurement or later) | Change the value with "▲" or "▼". |
| | MODE 1: The range in which three focus bars indicated (for the second measurement or later) | Change the value with "▲" or "▼". |
| | MODE 2: The range in which five focus bars are indicated (for the second measurement or later) | Change the value with "▲" or "▼". Revert to "MODE 0" with ⓒYL. |
| 44 | Auto-shot start counter (for the first measurement) | Change the value with "▲" or "▼". |
| 45 | Auto-shot start counter (for the second measurement or later) | Change the value with "▲" or "▼". |
| 46 | MODE 0: Auto-tracking stop range X | Change the value with "▲" or "▼". |
| | MODE 0: Auto-tracking stop range Y | Change the value with "▲" or "▼". Revert to "MODE 0" with ⓒYL. |
| 47 | Auto-shot: Time-out at serial measurement | Change the value with "▲" or "▼". |

・SAGITTAL MODEL (▼) (only for ARK-700 series and SW6 is set to the ON position)

| Mode No. | Function | Remarks |
|---|---|---|
| 50 | Sagittal model select<br>This should be set before shipment | Change the setting with "▲" or "▼".<br>0: Destined for overseas 1: Destined for OCULUS |

Common operations: Start button The mode will be switched to the next mode.

⊙..... The setting will be printed out.

⊙.....The instrument revert to the Menu mode.

# §13 Replacing ROM (Program)

R&D division releases Technical Bulletin every time the ROM version changes. If the program is not proper for your instrument, replace ROM with a correct one.
Remember that all types of instrument has IC2 commonly installed. However, the earlier program version is not corresponding with AR-660A and ARK-760A.

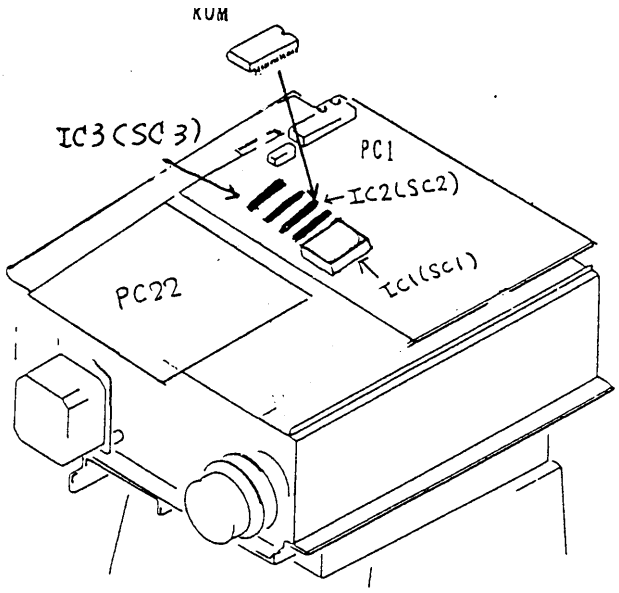
Replacement parts: 32906-E174/IC2

1. **Remove the Left, Right covers and frame.**
   **(See § 5.)**

2. **Extract ROM (IC2 and IC3).**
   Use a special CPU extractor if possible. If the tool is not available, use two screwdrivers instead. Insert the screwdriver blades to both sides of ROM and lift it off.

3. **Install the new ROM, paying attention to its fixed orientation.**
   Mount it in a horizontal position.
   * Take care not to touch the contact surface of ROM. The corrosion may cause contact failure.

4. **Set parameters, date and time and comment according to the instructions on Operator's Manual.**



# §14 List of SW1 and SW2 operations

**Functions of DIP SW (SW1)**

## Functions of AR-10 (A)/RK-4 (A) DIP SW

• Functions of DIP SW

| SW No. | Function | OFF | ON |
|---|---|---|---|
| 1 | RESERVE | Factory setting: OFF | ———— |
| 2 | RESERVE | Factory setting: OFF | ———— |
| 3 | RESERVE | Factory setting: OFF | ———— |
| 4 | Adjustment mode (AR, KM, OTHER) | Normal mode | Adjustment mode |
| 5 | Dimming ON/OFF | Dimming ON | Dimming OFF |
| 6 | Sagittal setting (KM model) | Without sagittal | With sagittal |
| 7 | Printer setting (line printer/serial printer) | Line printer | Serial printer |
| 8 | Import (valid/invalid) | Valid (LM) | IC card |

## Functions of AR-10 TYPE Ⅱ DIP SW

• Functions of DIP SW (for V4.00)

| SW No. | Function | OFF | ON |
|---|---|---|---|
| 1 | RESERVE | Factory setting: OFF | ———— |
| 2 | Printer setting (SW No.7: valid/new line printer) | ———— | Line printer |
| 3 | RESERVE | Factory setting: OFF | ———— |
| 4 | Adjustment mode | Normal mode | Adjustment mode |
| 5 | Dimming ON/OFF | Dimming ON | Dimming OFF |
| 6 | RESERVE | Factory setting: OFF | ———— |
| 7 | RESERVE | Factory setting: OFF | ———— |
| 8 | Import (valid/invalid) | Valid (LM) | Invalid (IC card) |

## Functions of AR-10B/RK-4B DIP SW

• Functions of DIP SW

| SW No. | Function | OFF | ON |
|---|---|---|---|
| 1 | RESERVE | Factory setting: OFF | ———— |
| 2 | RESERVE | Factory setting: OFF | ———— |
| 3 | Domestic/overseas index setting | Domestic index | Overseas index |
| 4 | Adjustment mode (AR, KM, OTHER) | Normal mode | Adjustment mode |
| 5 | Dimming ON/OFF | Dimming ON | Dimming OFF |
| 6 | Sagittal setting (KM model) | Without sagittal | With sagittal |
| 7 | Printer setting (line printer/serial printer) | Line printer | ———— |
| 8 | Import (valid/invalid) | Valid | Invalid (IC card) |

**Functions of ROTARY SW (SW2)**

## Function of ROTARY SW (Except AR-10 TYPE Ⅱ)

• Functions of ROTARY SW

| No. | Model Code | Model |
|---|---|---|
| 0 | AR-10 | AR-600 |
| 1 | AR-10A | AR-600A |
| 2 | AR-10B | AR-660A |
| 3 | NOT USED | NOT USED |
| 4 | NOT USED | NOT USED |
| 5 | RK-4 | ARK-700 |
| 6 | RK-4A | ARK-700A |
| 7 | RK-4B | ARK-760A |
| 8 | NOT USED | NOT USED |
| 9 | NOT USED | NOT USED |

## Function of ROTARY SW (AR-10 TYPE Ⅱ)

• Functions of ROTARY SW

| No. | Model code | Model |
|---|---|---|
| 0 | NOT USED | NOT USED |
| 1 | NOT USED | NOT USED |
| 2 | NOT USED | NOT USED |
| 3 | AR-10 | AR-600 type Ⅱ |
| 4 | NOT USED | NOT USED |
| 5 | NOT USED | NOT USED |
| 6 | NOT USED | NOT USED |
| 7 | NOT USED | NOT USED |
| 8 | NOT USED | NOT USED |
| 9 | NOT USED | NOT USED |

Program functions are set with the ROTARY SW. (Refer to the comparative chart of model and functions.)

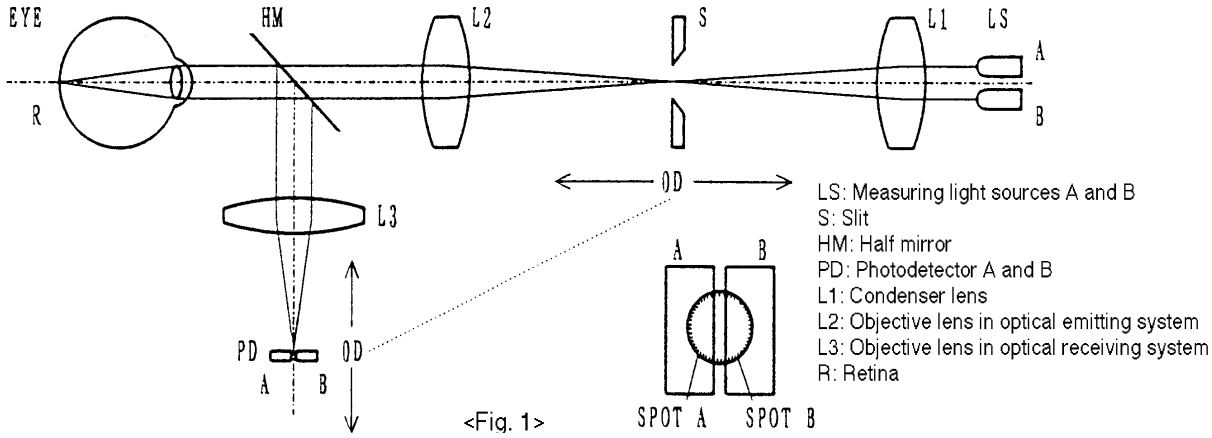
# §15 Principle of Measurement

## 1. Outline of AR measurement principle

AR-600 and ARK-700 series uses invisible infrared rays as the light source for measurement. The infrared rays are projected thorough the slit on the patient's retina, and the image formation on the Patient's retina is detected by the photodetector and transmit it to the mechanism that determine the refractive power.
NIDEK Auto Refractometer derives the patient's refractive power from a slit travel by servo mechanism and from calculation by microcomputer.

## 2. Description of AR measurement principle

The Figure 1 illustrates the optical system; the slit images (S) are projected on the retina (R) by the light sources (LS) and the refracted light from the retina reaches the photodetector (PD). The light sources are located at A and B as shown in the figure.
The slit with a round aperture moves in accordance with the photodetector. The slit images projected by the light sources pass through the objective lens in optical emitting system (L2) and they are focused on retina through the patient's crystalline lens.
The slit images formed on the retina are refracted by the half mirror (HM) again through the objective lens in optical receiving system (L3) and finally the images are formed on the photodetector.



<Fig. 1>

Fig.1 illustrates the optical system when measuring emmetropia. The slit is located at the focal distance of the objective lens in optical emitting system. The slit images are properly projected on the retina through the objective lens in optical emitting system and the patient's crystalline lens. The figure shows that the slit images thrown by the light sources A and B coincide SPOT A and SPOT B on the photodetectors A and B. Assuming that the slit position for emmetropia is at 0D, it moves according to the refractive power of myopia or hyperopia.

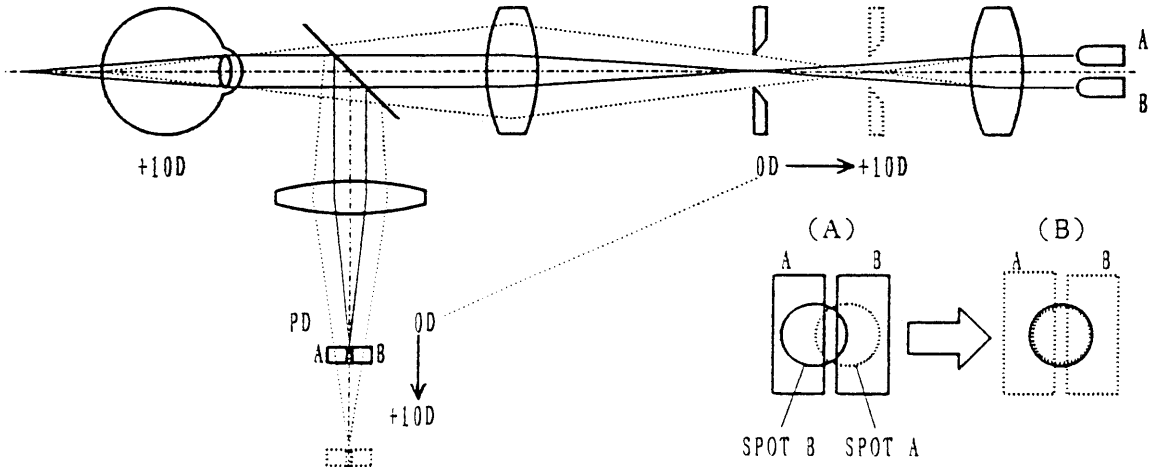
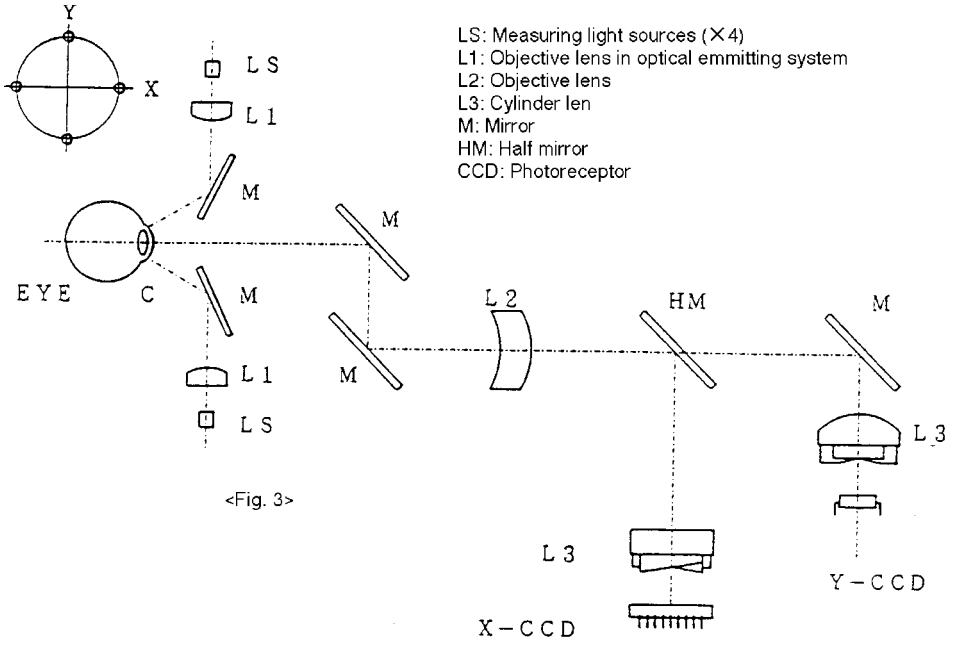



Fig. 2 illustrates the optical system when measuring hyperopia. If the slit is located at the focal distance of the objective lens in optical emitting system, the slit images do not coincide with each other on the retina; the photodetector A receives light mainly from SPOT B. On the other hand, the photodetector B receives light mainly from SPOT A. The slit moves in the positive direction until the image formation on the photodetectors achieves the (B) state in the figure.

In the case of myopia, the slit moves in the negative direction.

The SPH, CYL and AXIS values are given by the microcomputer after obtaining the refractive power of each meridian.

## 3. Outline of KM measurement principle




<Fig. 3>

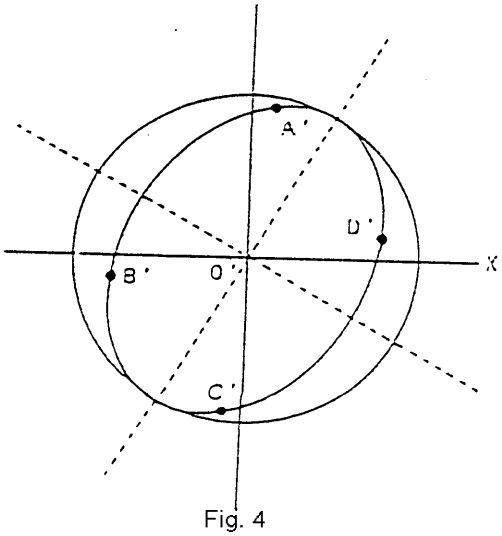



Fig. 4

Fig 3 illustrates the optical system in which the light sources are projected on the cornea and the refracted light from the cornea reaches the photoreceptors. The figure shows that there are two measuring lights arranged in horizontal direction and the other two lights in vertical direction.

Fig. 4 illustrates the position of refracted image (virtual image) on the cornea when four measuring lights are projected on the cornea.

Corneal radius on both 1st and 2nd principle meridians and cylinder axis on the patient's cornea are calculated in the measurement.
They are derived by computing the placement of at least three lights images projected on the cornea, rather than computing positions of each light. This is because that the refracted images are focused on the photoreceptors (CCD).

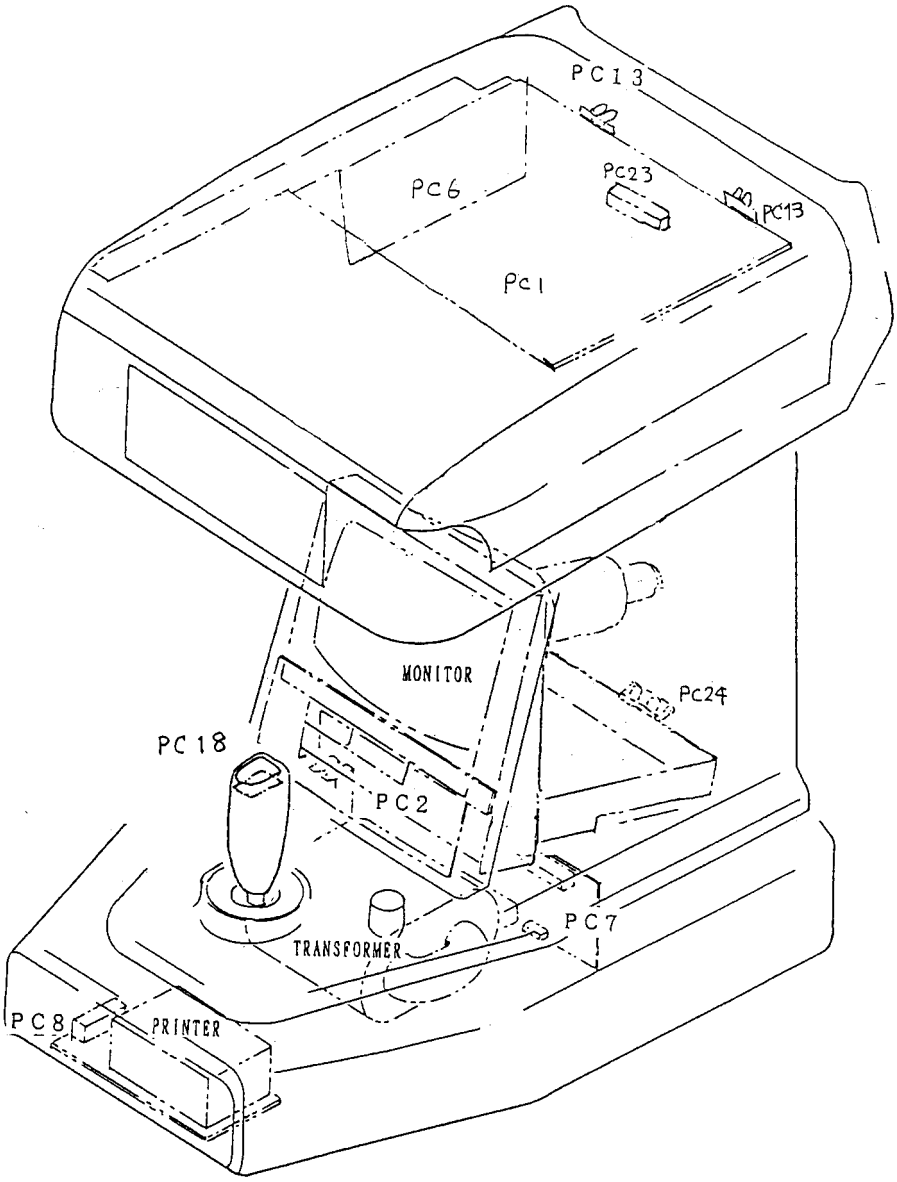
**CCD lenear image sensor**

The CCD linear image sensor on which micro-photodiodes are in line detect relative spacings between imcoming rays.

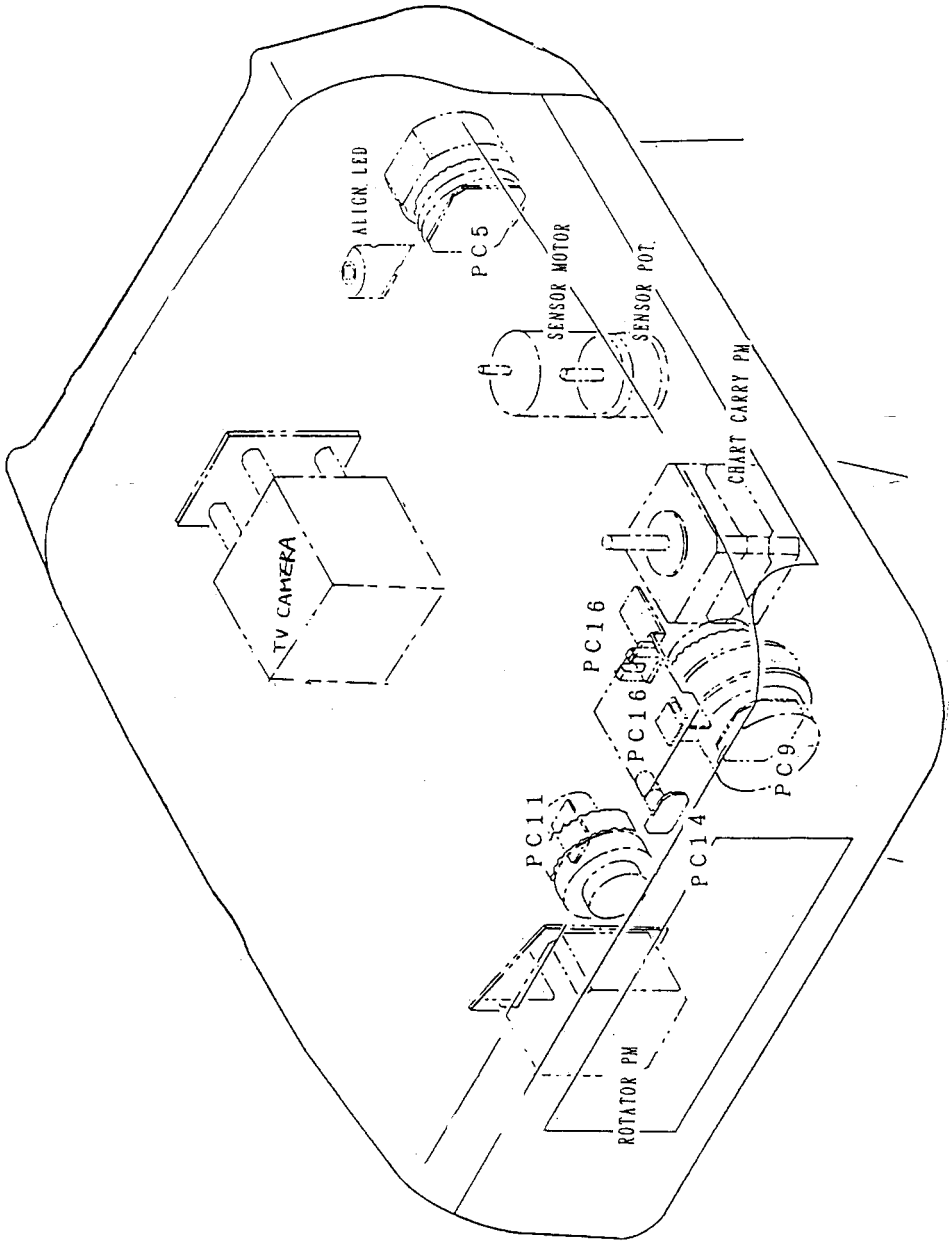
The bit number of the spacing between A and B spotlights can be obtained by measuring $t_{A\ -\ B}$ with a certain unit of clock signal. The spacing can be detected since one bit of photoreceptor is known.

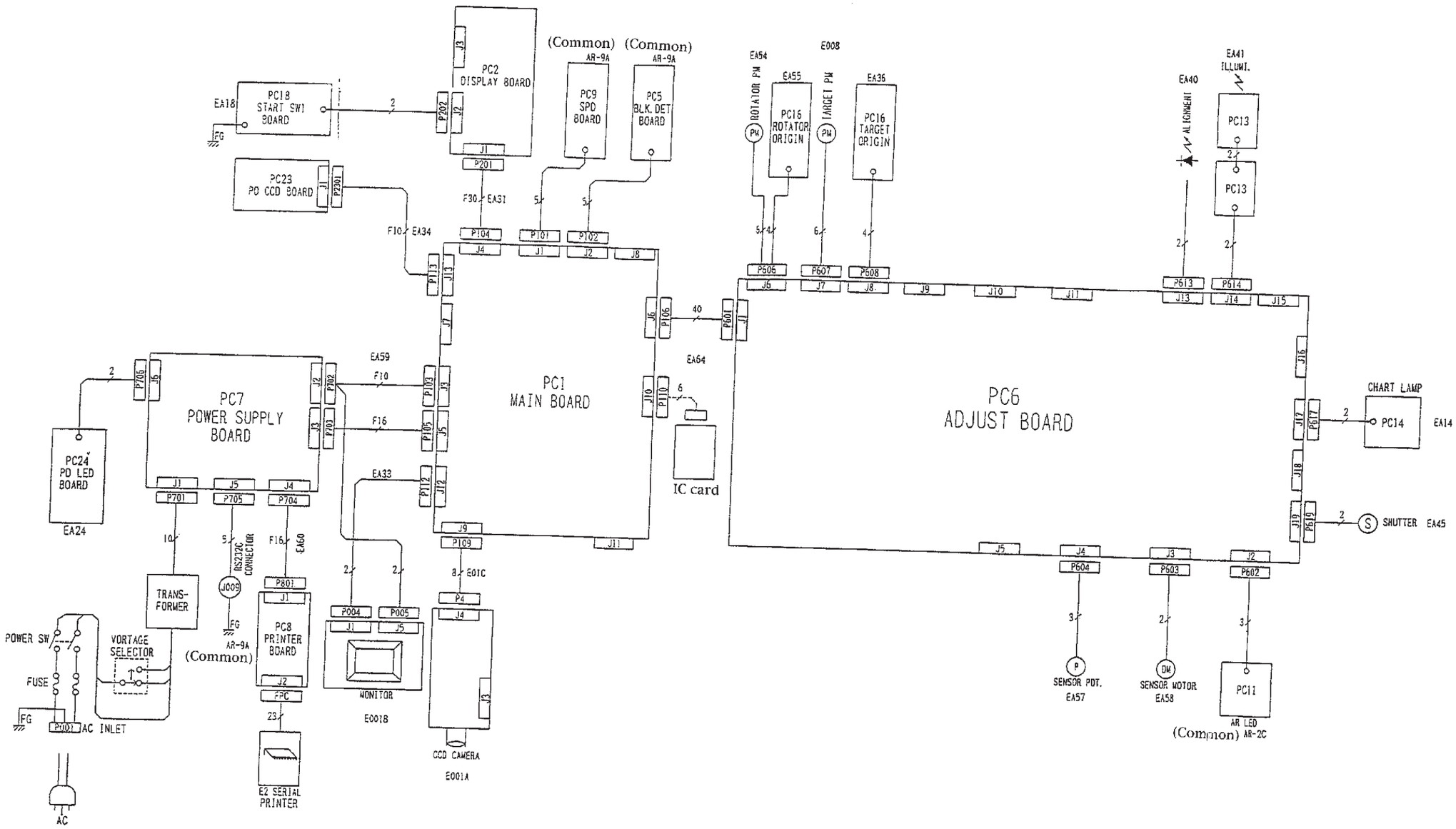
Since CCD has an extremely-narrow spacing, the virtual image is deviated from the photoreceptor and it cannot be detected. Therefore, cylinder lens is placed in front of the photoreceptors (CCD) to lengthen each image to the direction in which each image crosses the axis at right angles.

• **AR-600 CONSTRUCTION DRAWING**



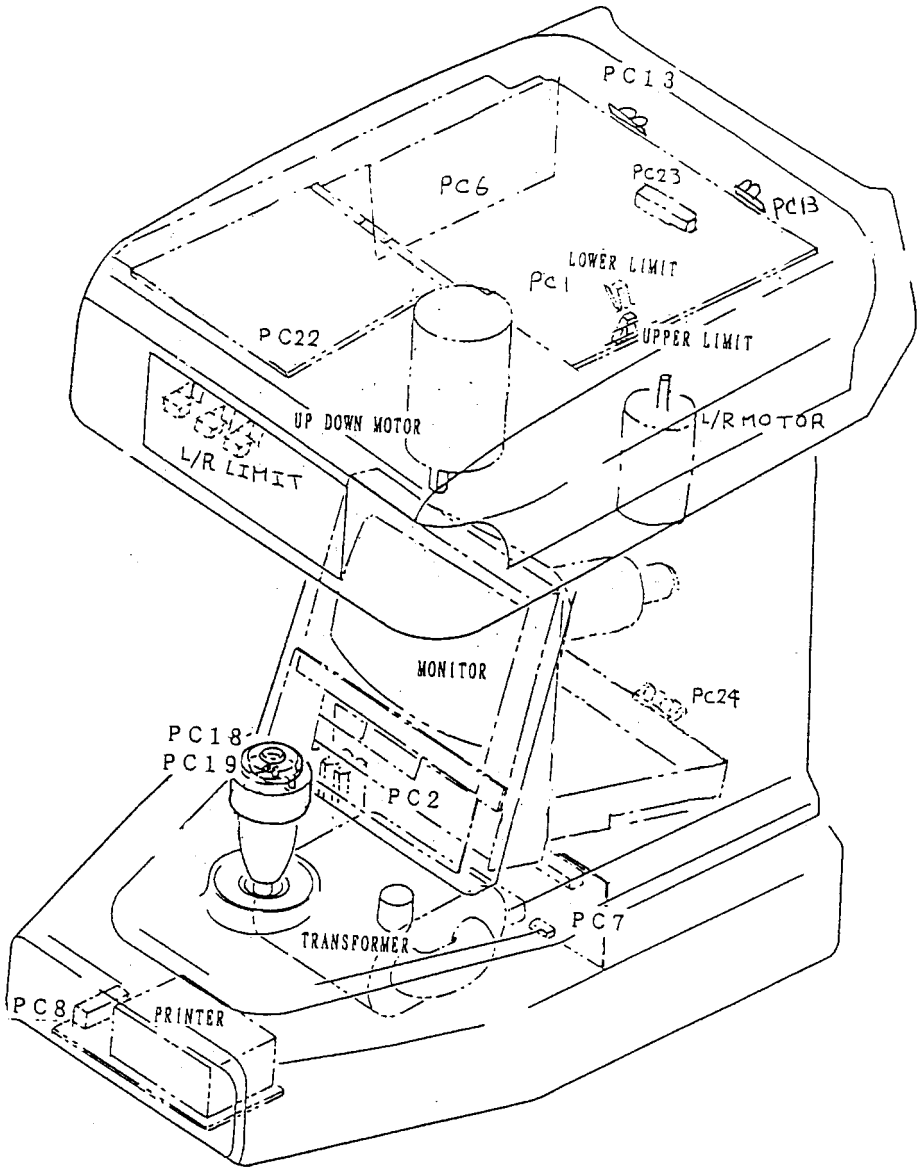
• **AR-600 CONSTRUCTION DRAWING**



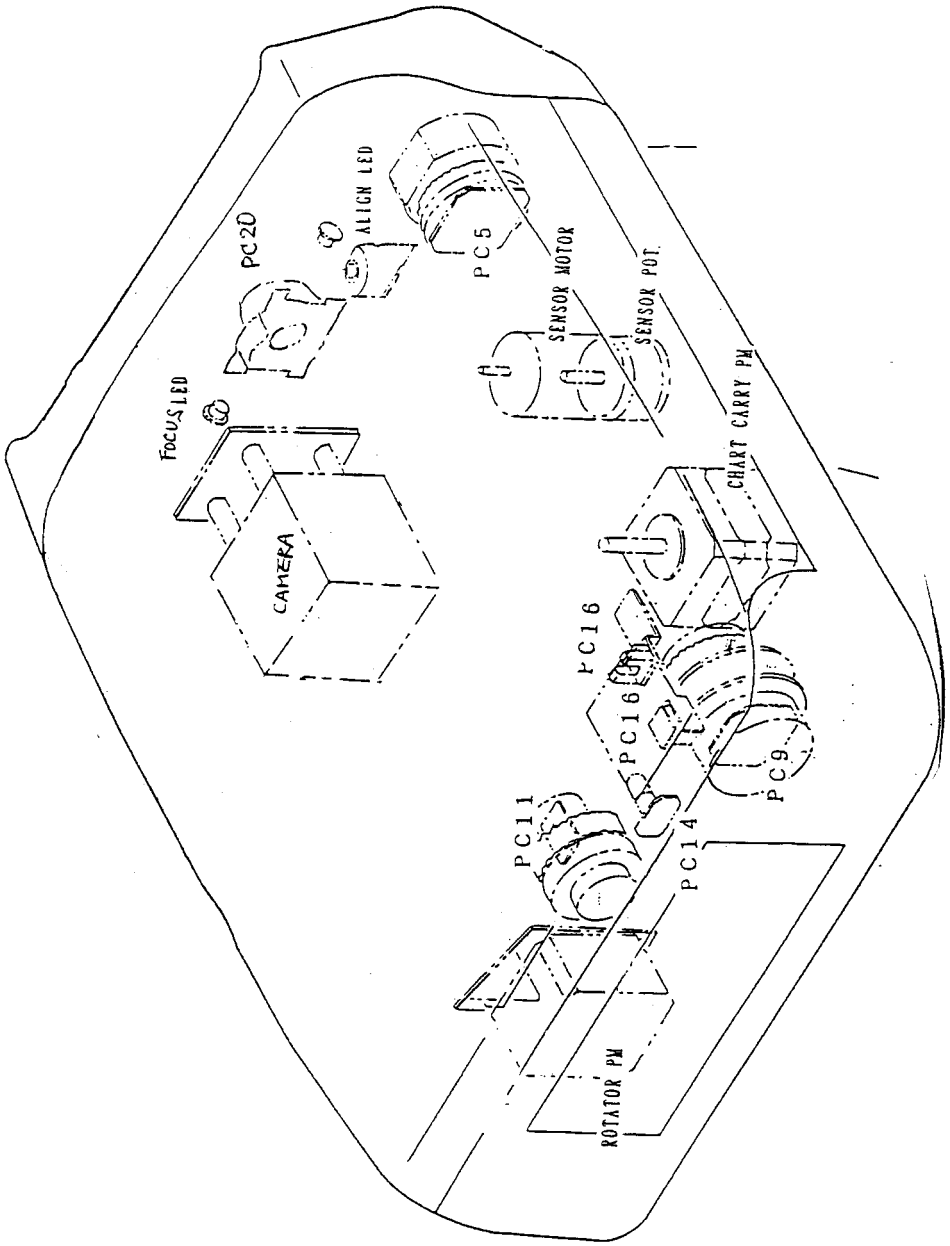


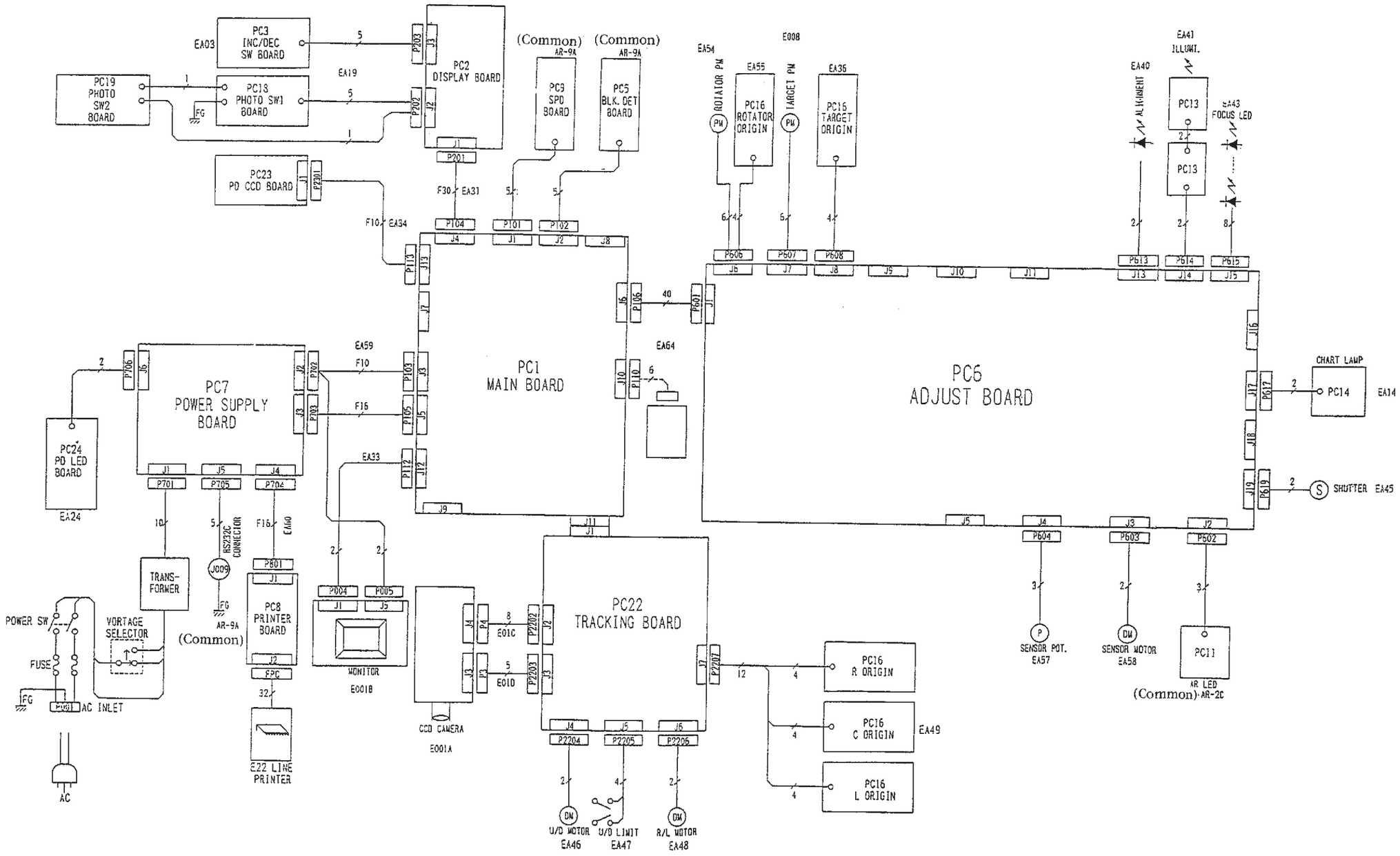

● AR-600 WIRING DIAGRAM

• **AR-600 CONSTRUCTION DRAWING**



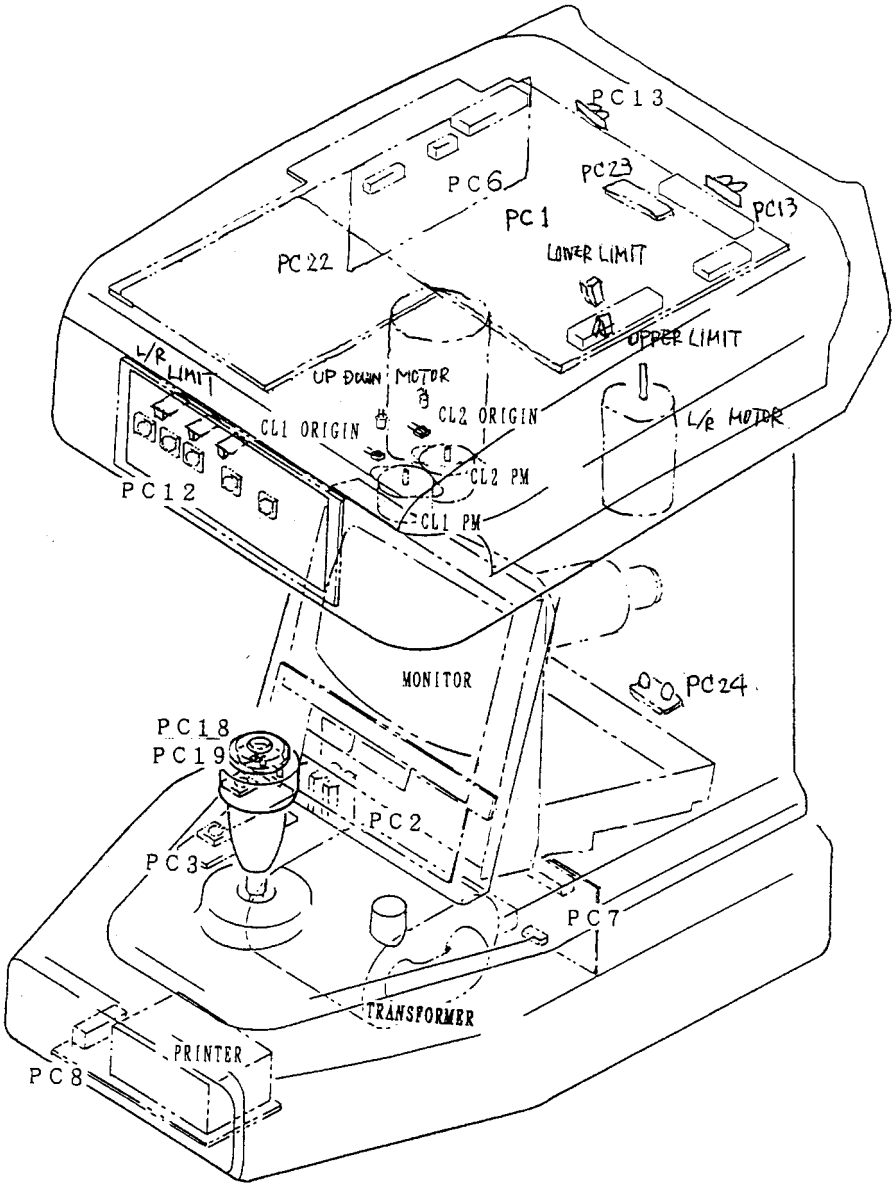
• **AR-600A CONSTRUCTION DRAWING**



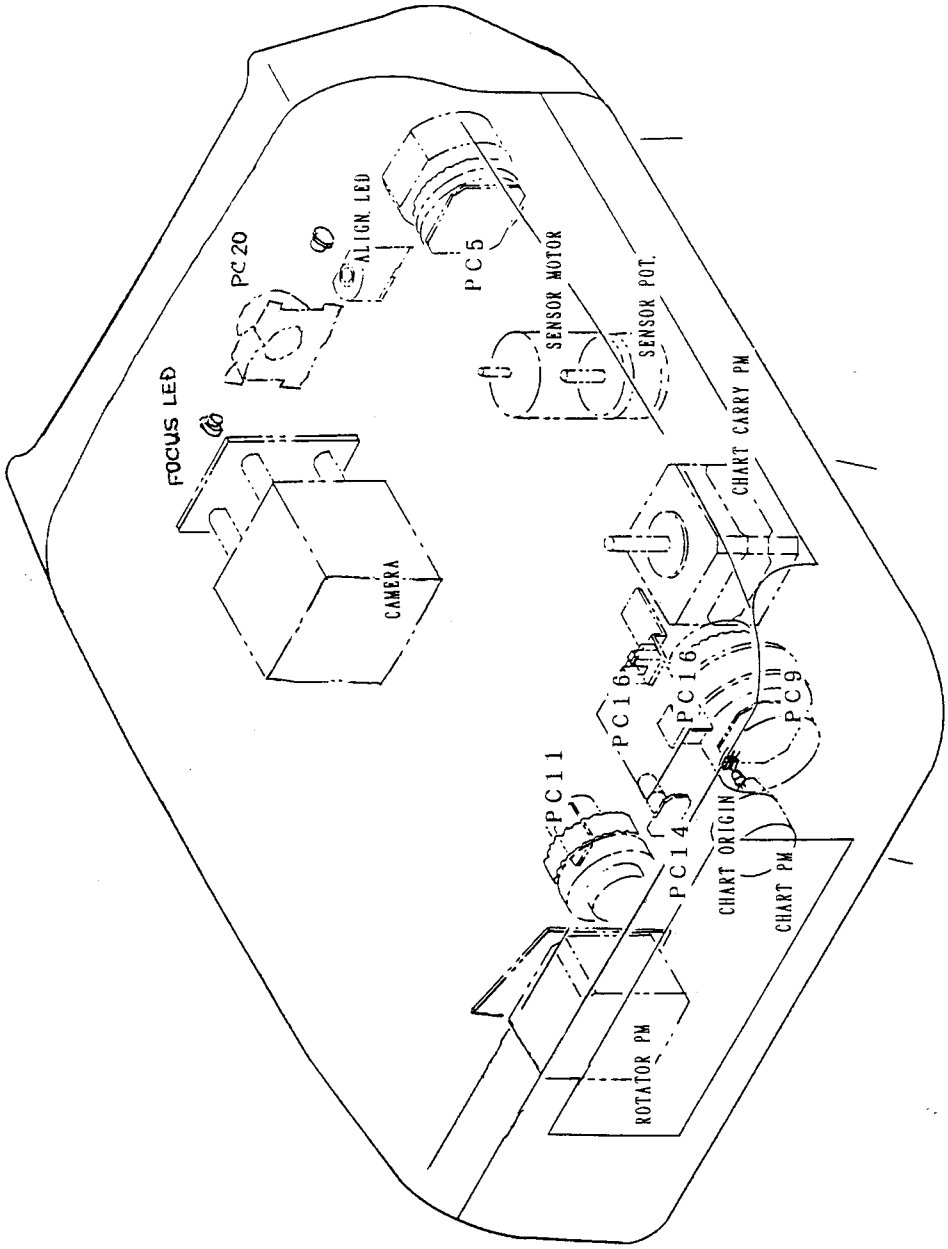


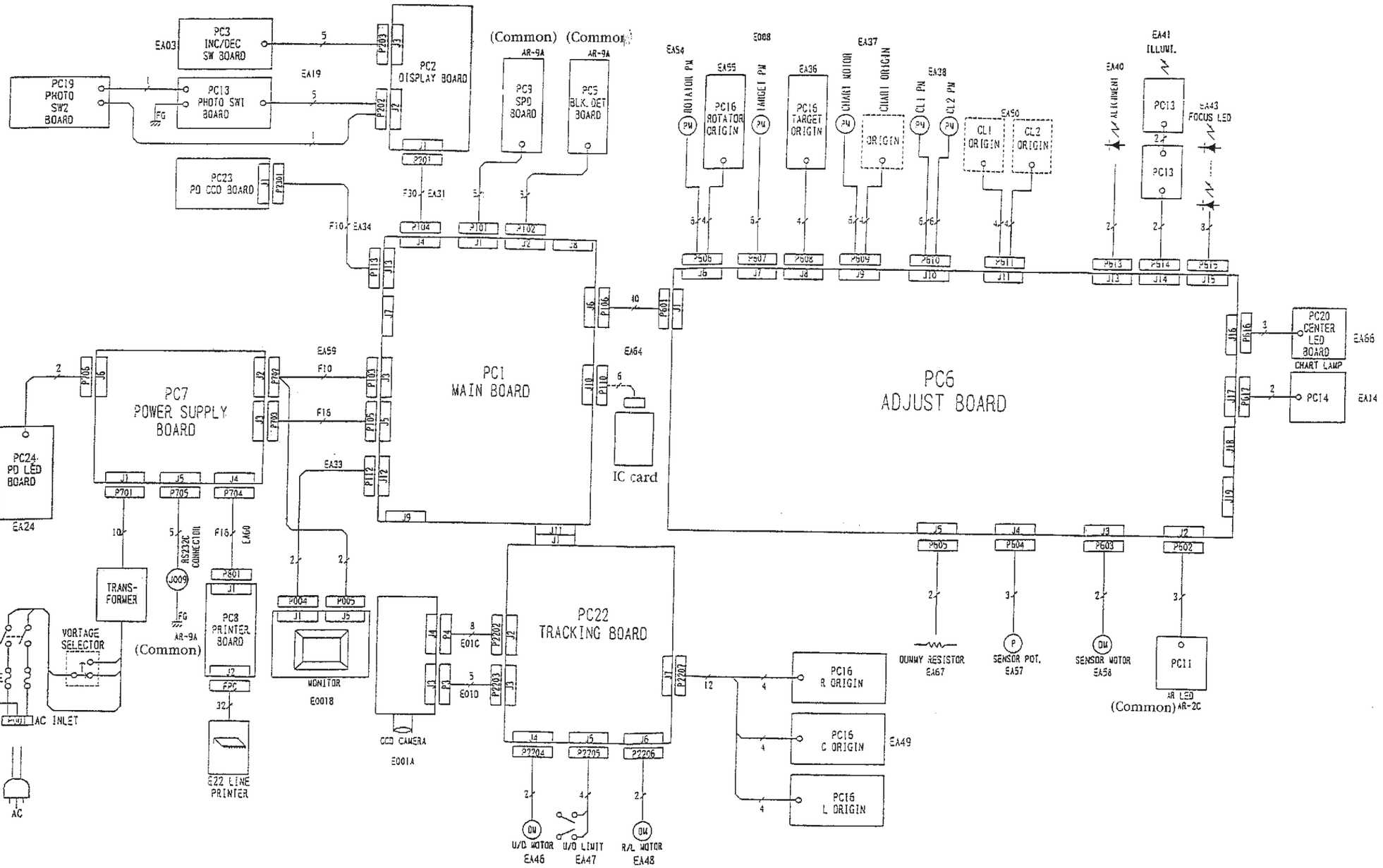

● AR-600A WIRING DIAGRAM

• **AR-660A CONSTRUCTION DRAWING**



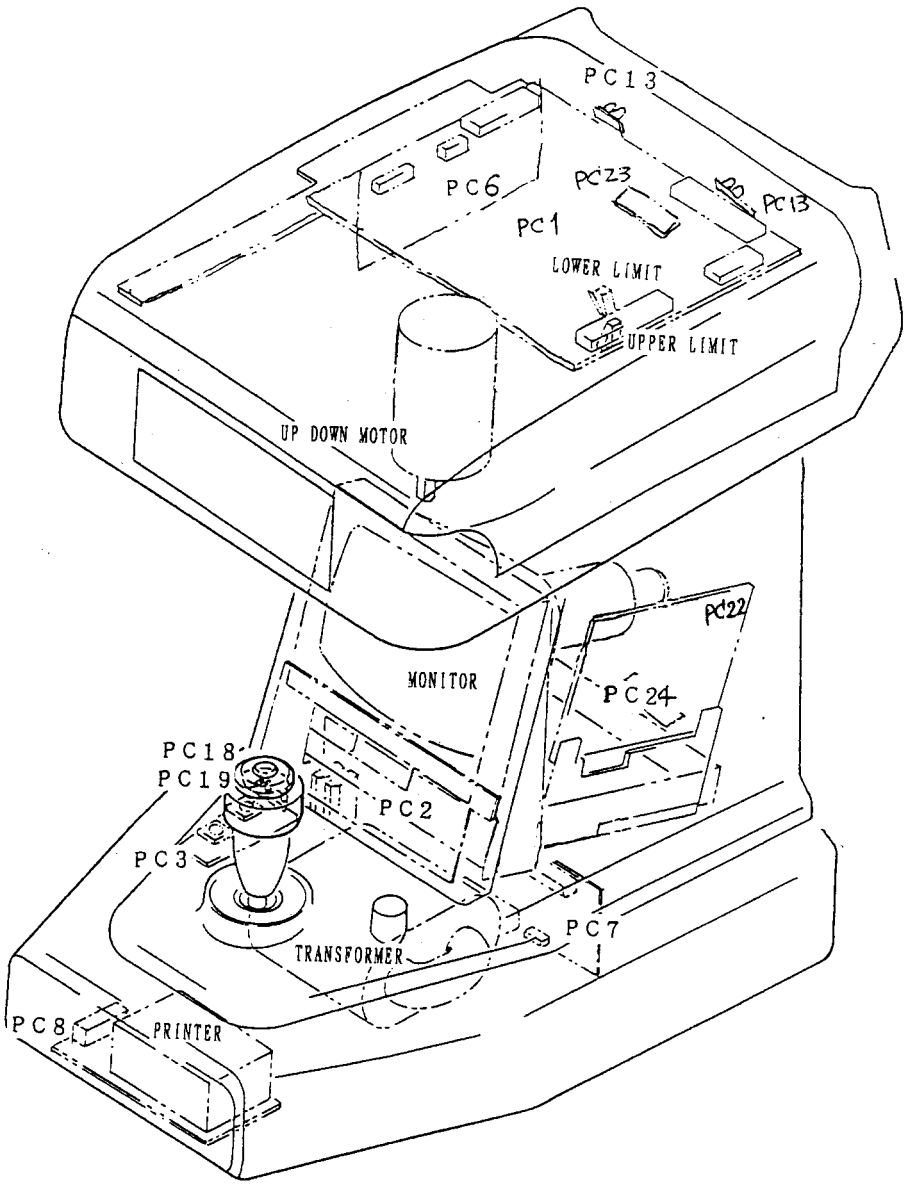
• **AR-660A CONSTRUCTION DRAWING**



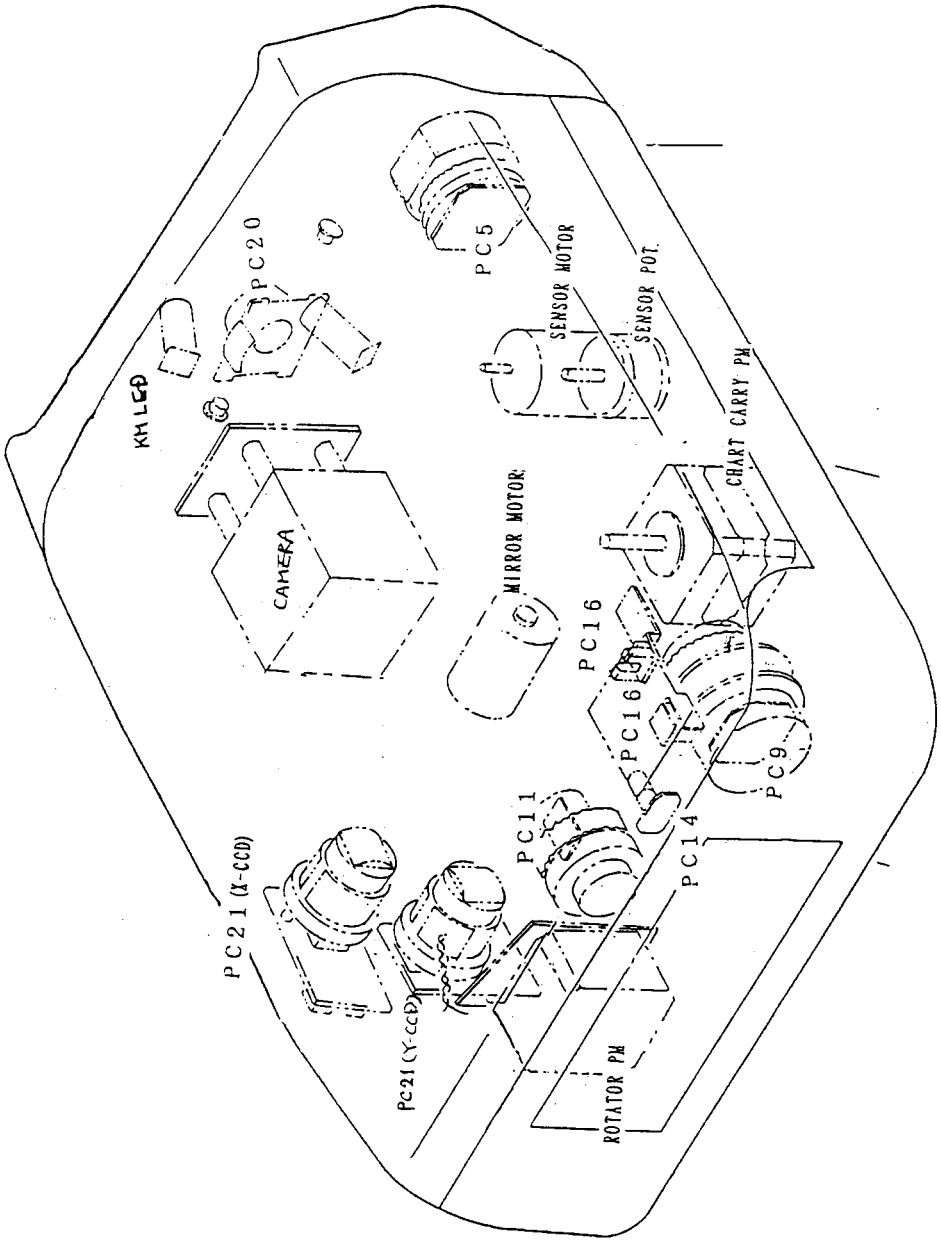


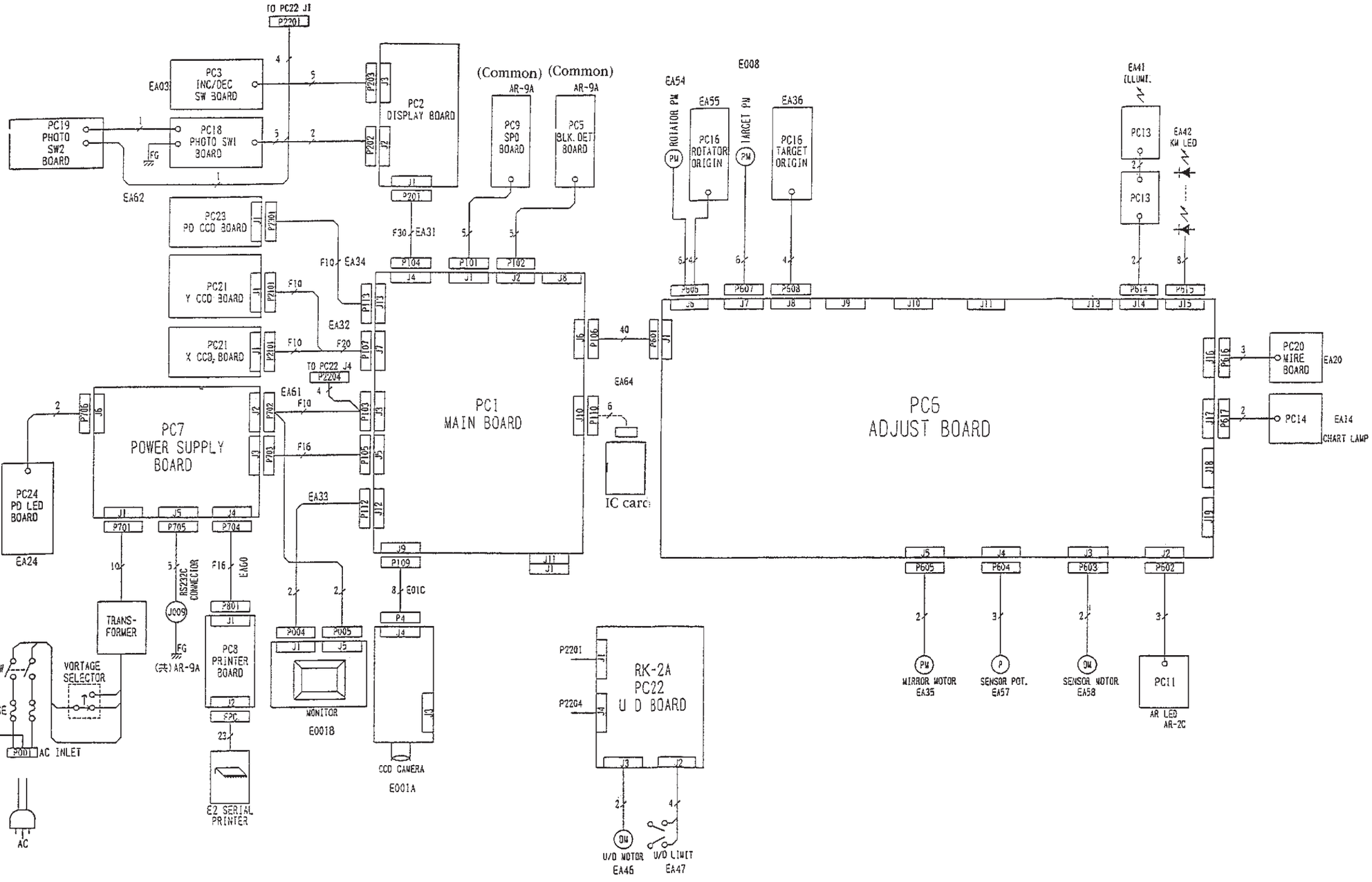

● AR-660A WIRING DIAGRAM

• **ARK-700 CONSTRUCTION DRAWING**



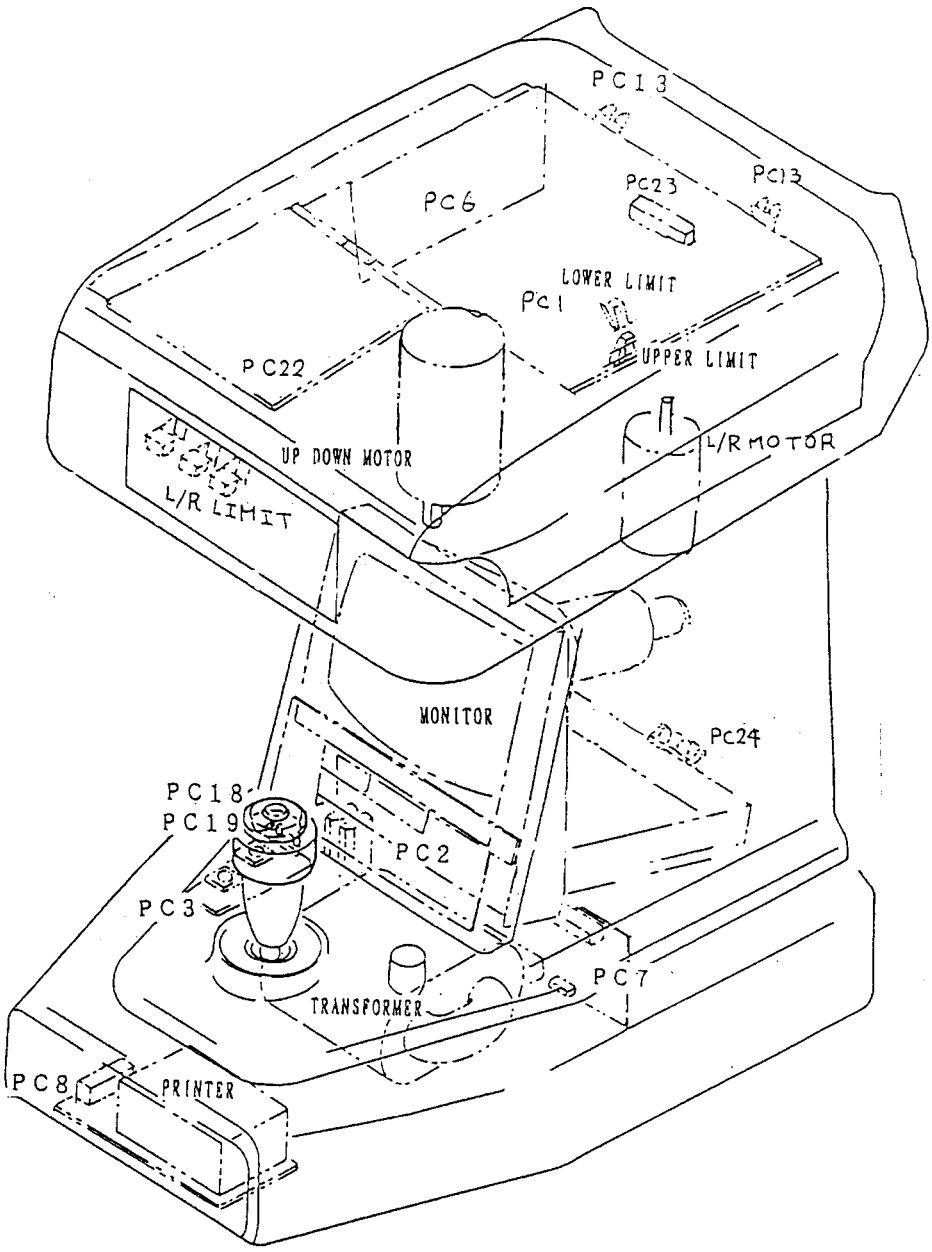
• **ARK-700 CONSTRUCTION DRAWING**



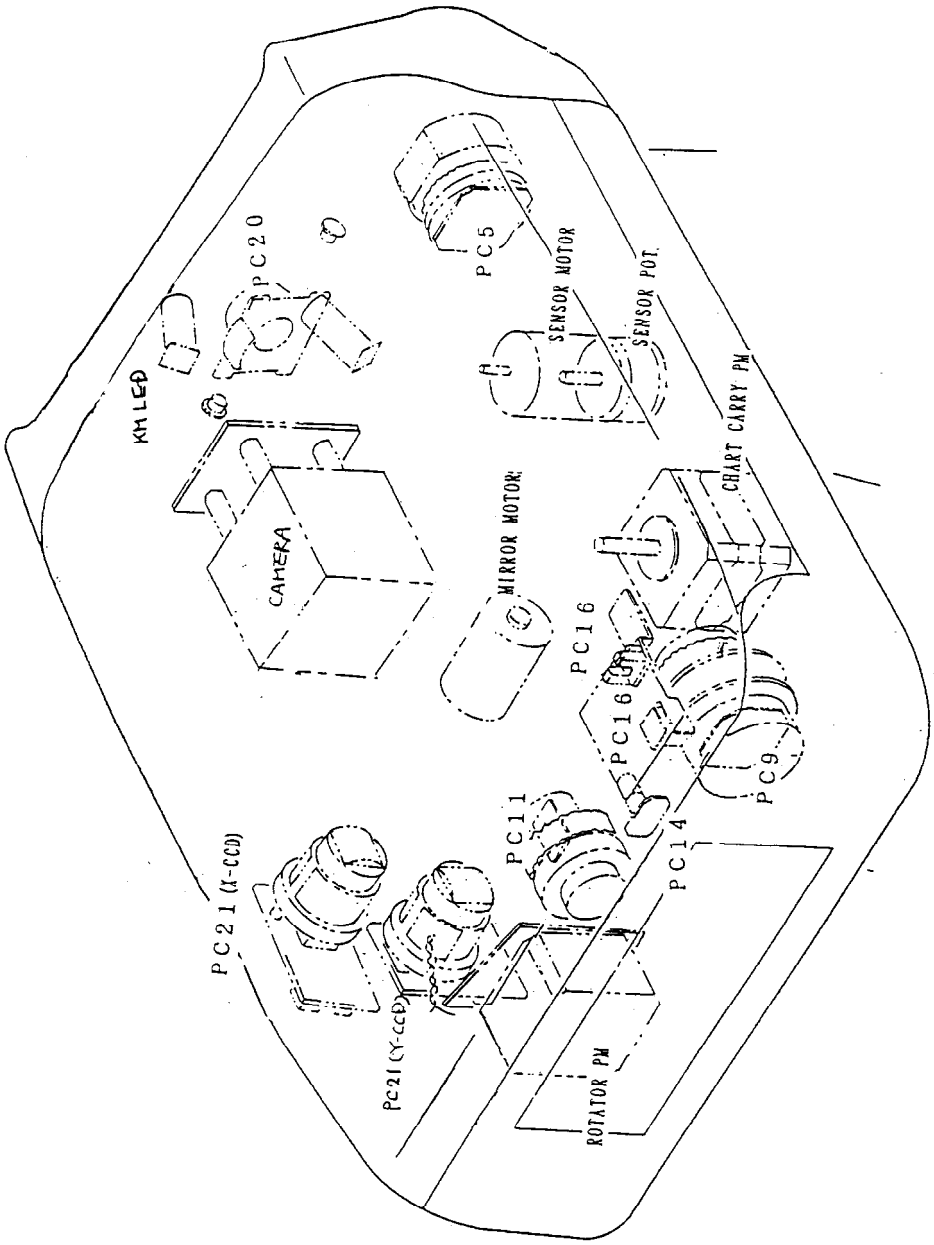


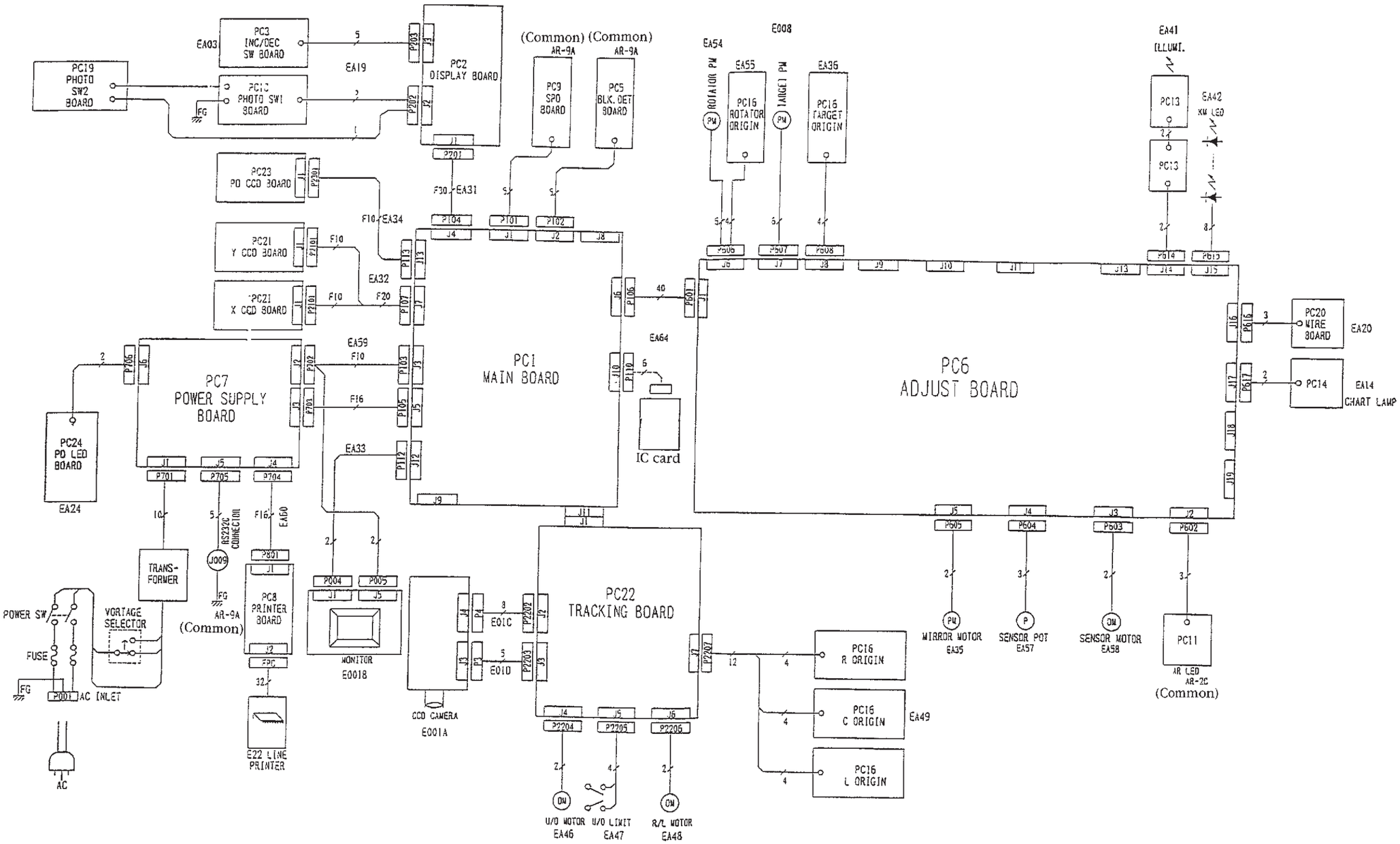

● ARK-700 WIRING DIAGRAM

• **AR-700A CONSTRUCTION DRAWING**



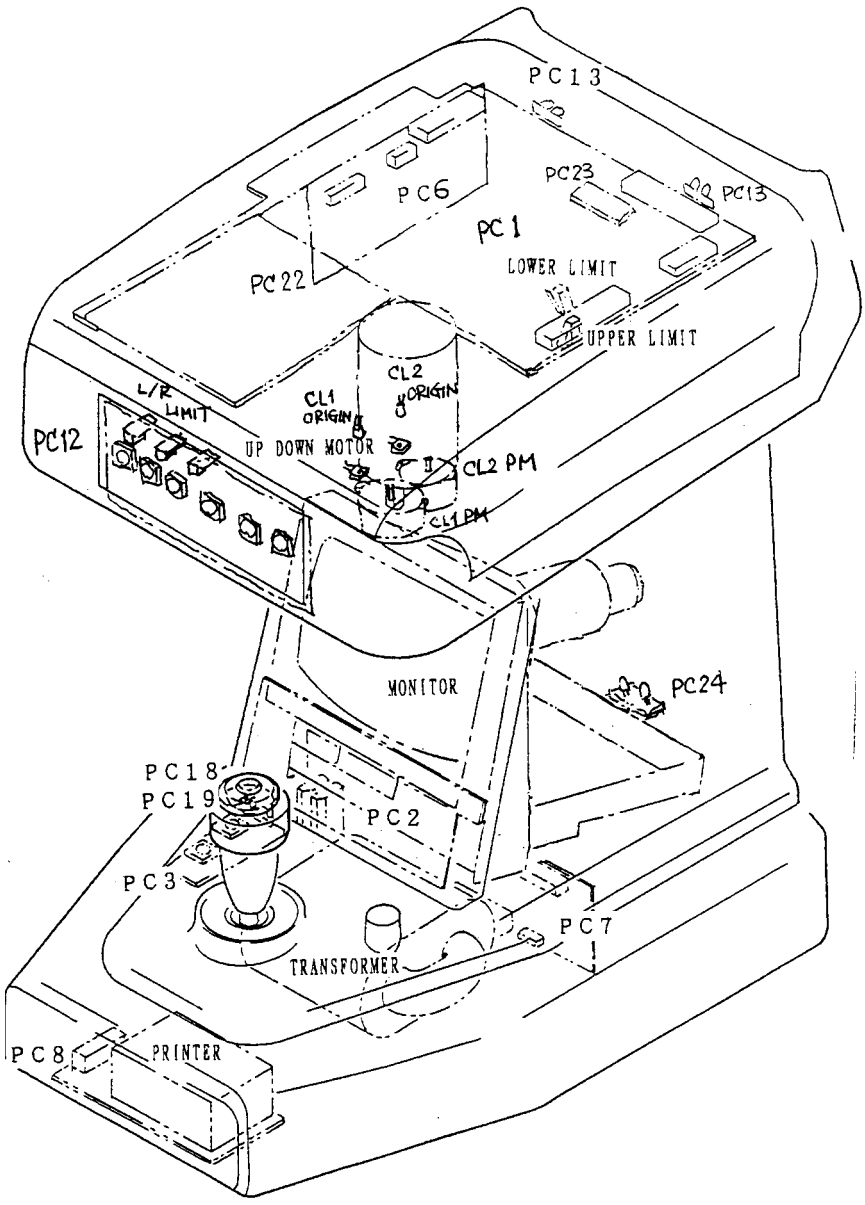
• **AR-700A CONSTRUCTION DRAWING**



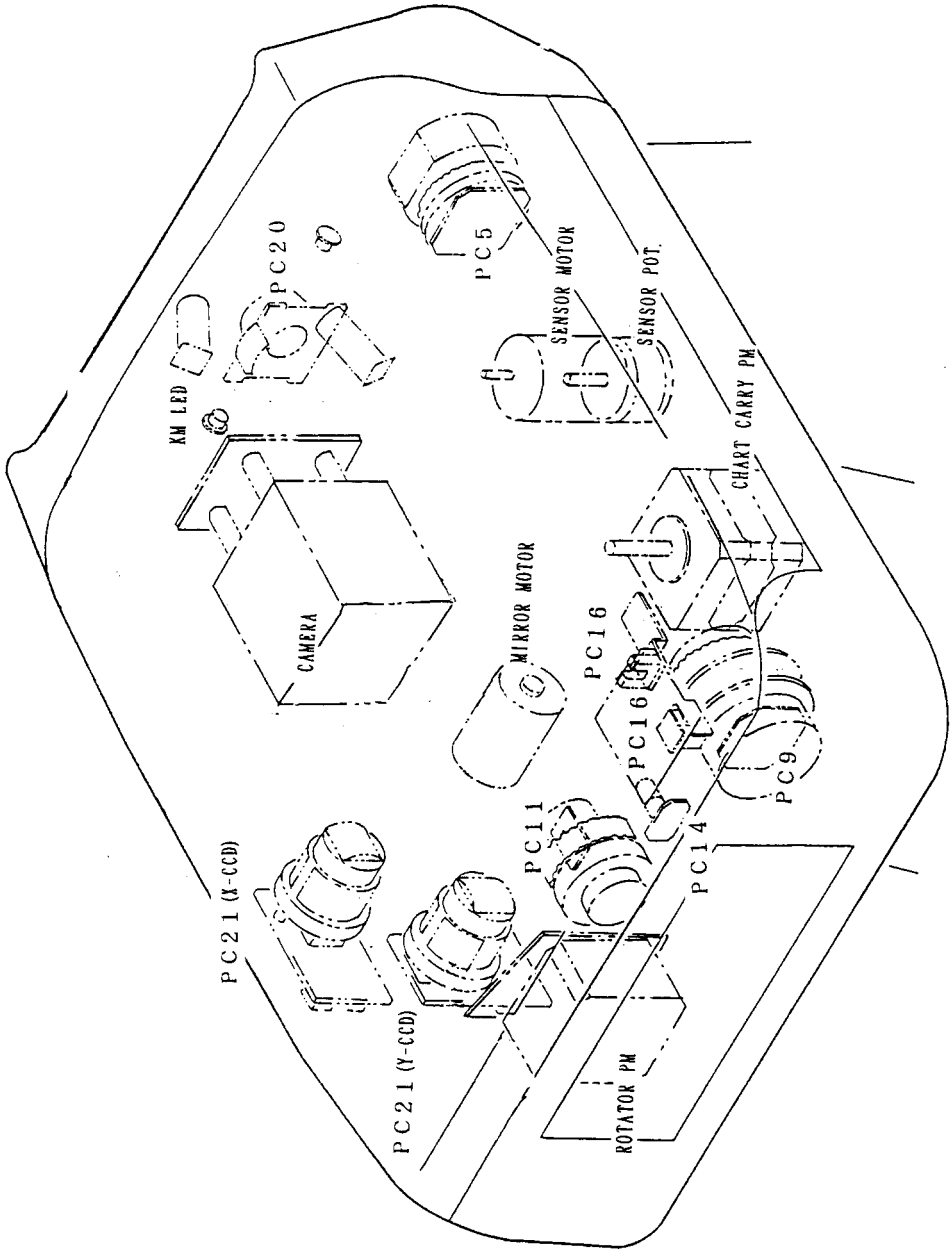


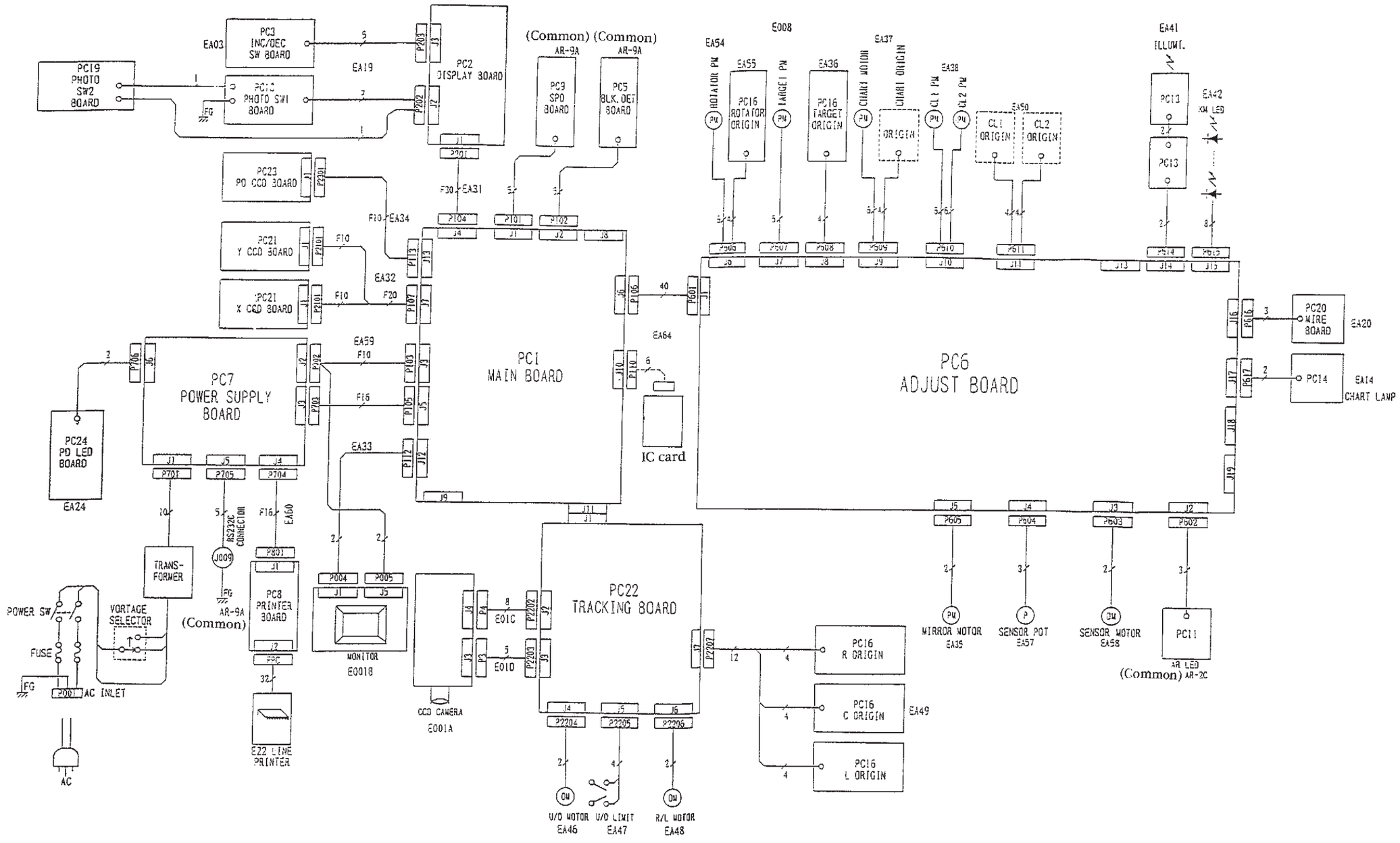

- ARK-700A WIRING DIAGRAM

• **AR-760A CONSTRUCTION DRAWING**

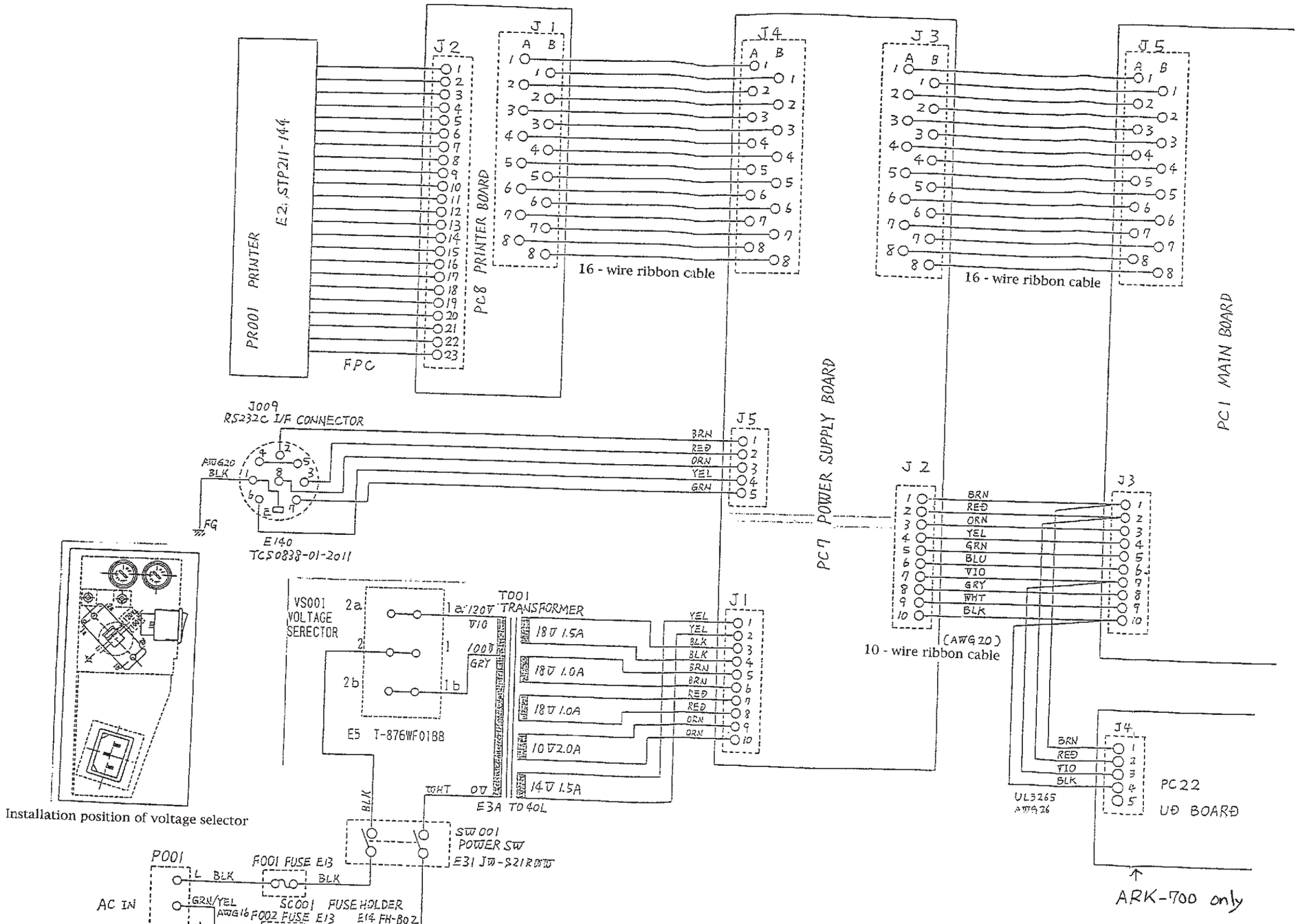


• **AR-760A CONSTRUCTION DRAWING**



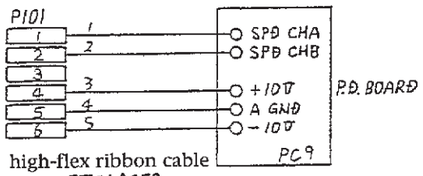



● ARK-760A WIRING DIAGRAM



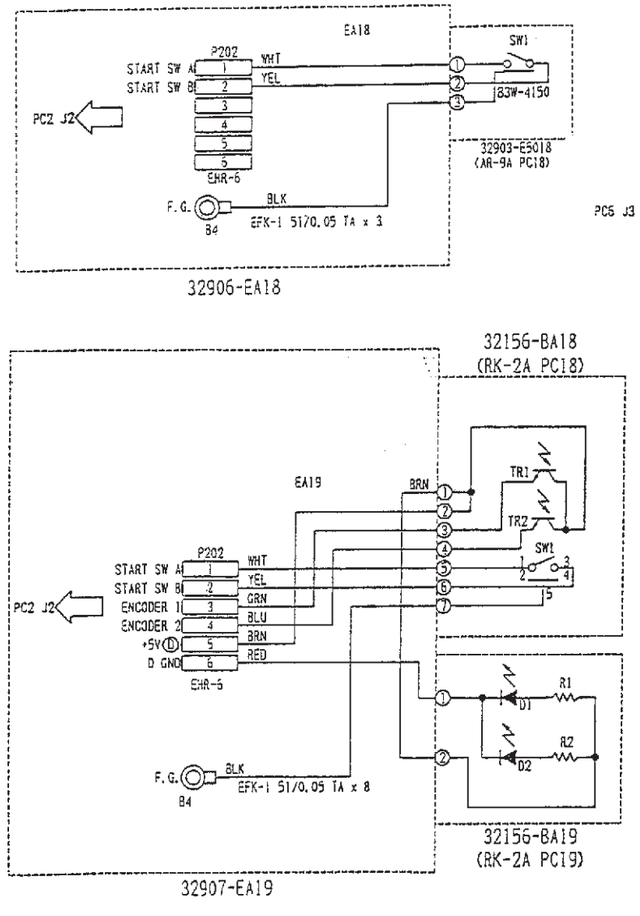

Installation position of voltage selector

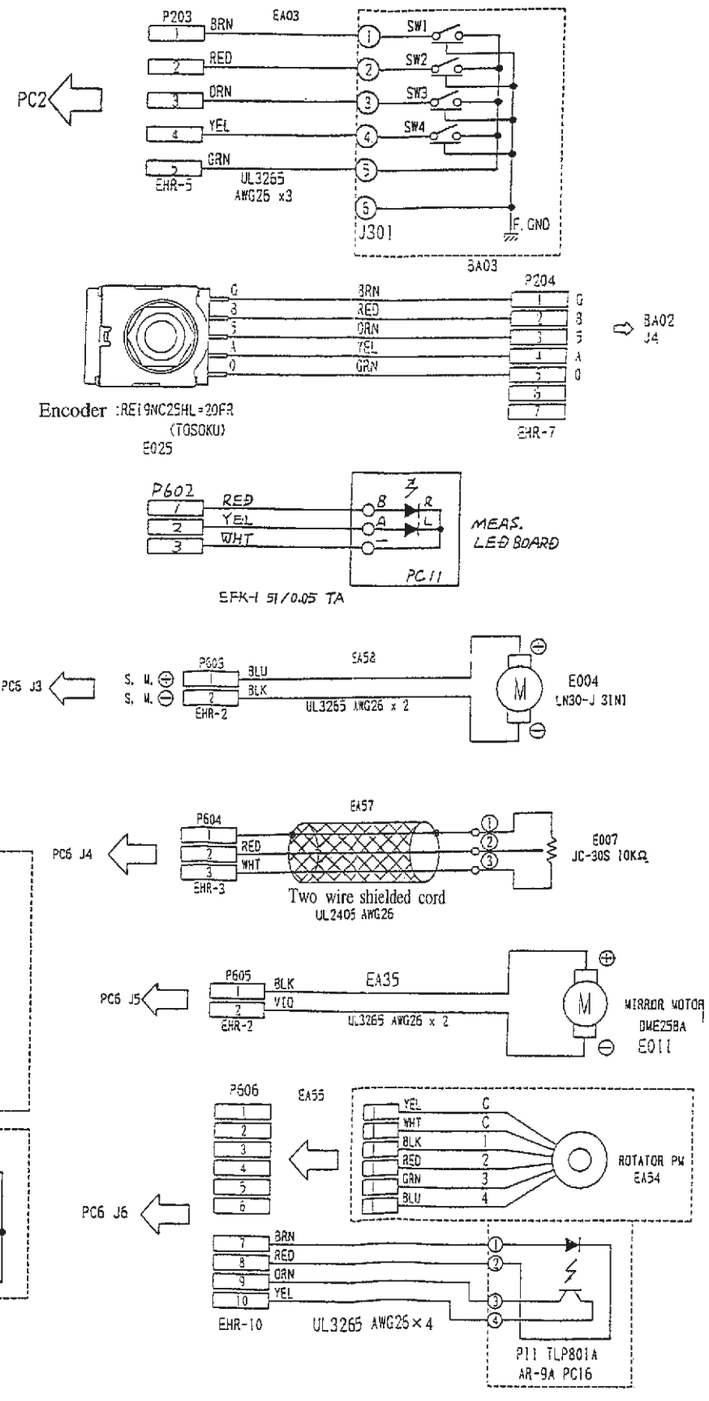
- AR-600,ARK-700 SERIES WIRING DIAGRAM

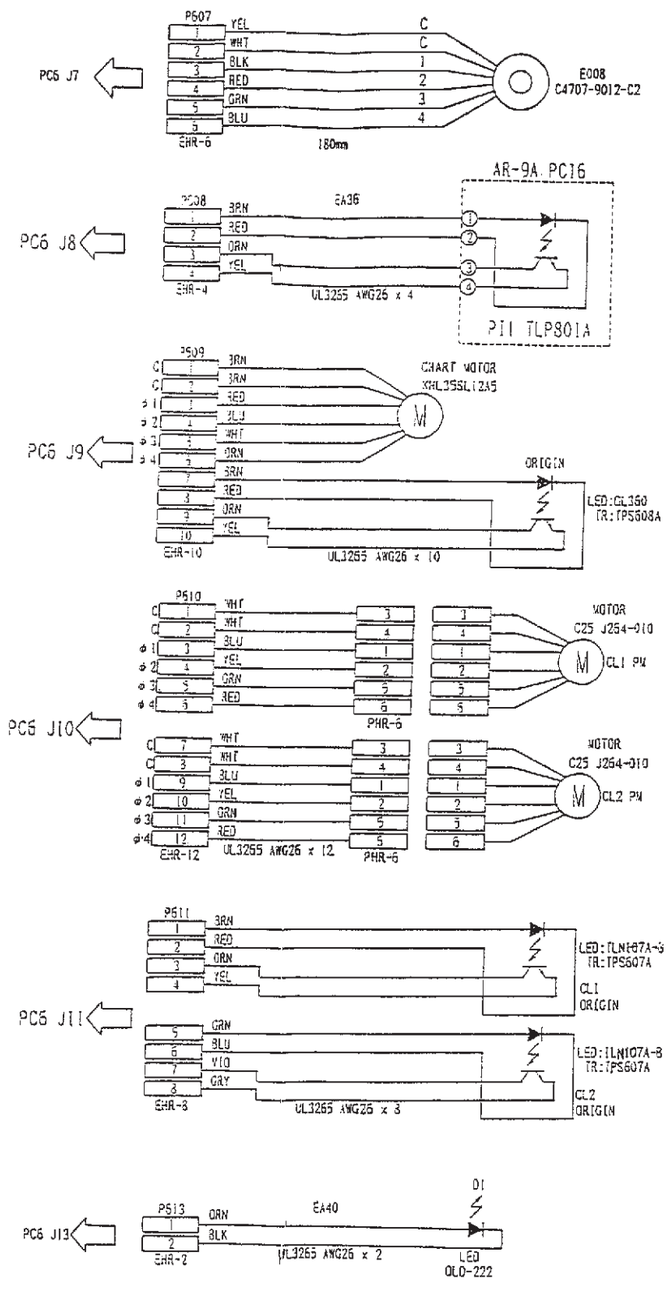




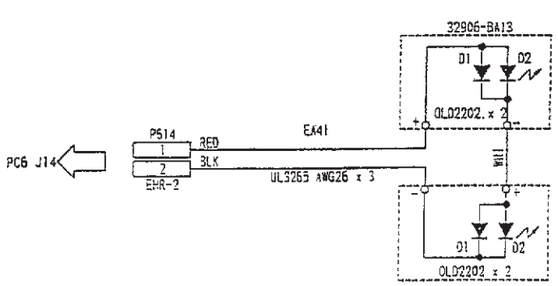


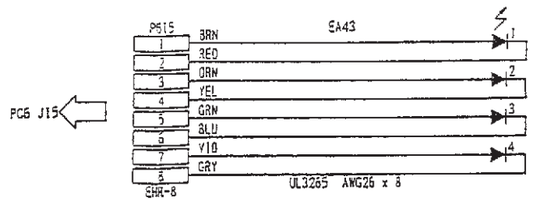


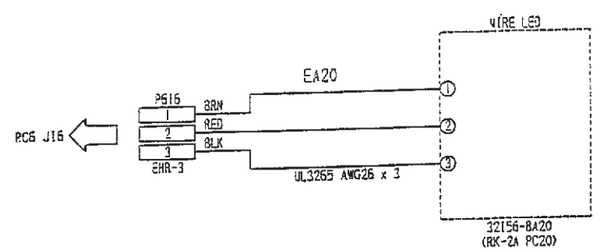




- AR-600,ARK-700 SERIES WIRING DIAGRAM


32806-BA13
D1
D2
OLD2202. x 2
P514
RED
BLK
EA41
PC6 J14
EHR-2
UL3265 AWG26 x 3
WHT
OLD2202 x 2


P515
BRN
RED
ORN
YEL
GRN
BLU
YLW
GRY
EA43
PC6 J15
EHR-8
UL3265 AWG26 x 8


WIRE LED
EA20
P516
BRN
RED
BLK
PC6 J16
EHR-3
UL3265 AWG26 x 3
32156-BA20
(RK-2A PC20)

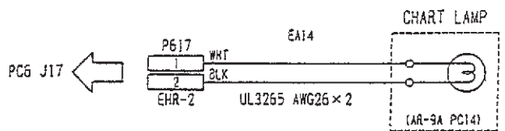
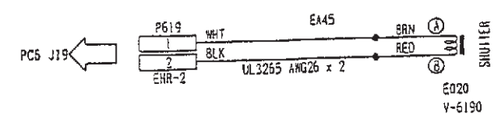
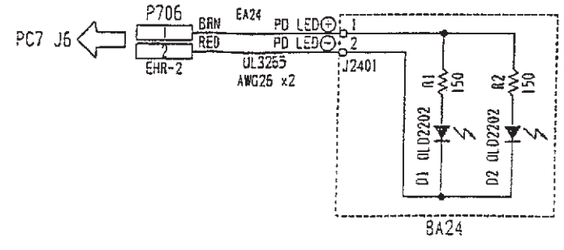
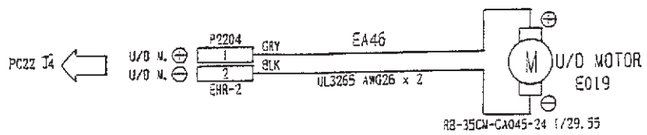
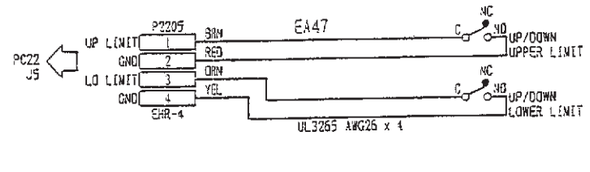


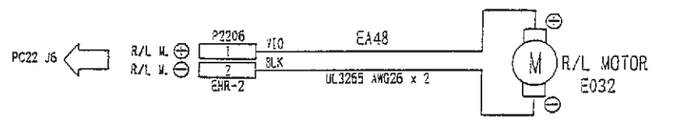
CHART LAMP
EA14
P617
WHT
BLK
PC6 J17
EHR-2
UL3265 AWG26×2
(AR-9A PC14)

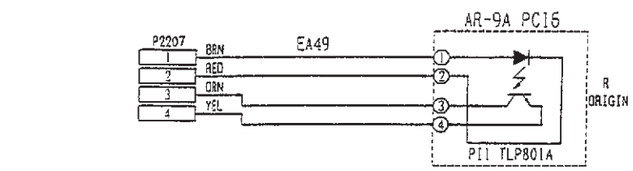

EA45
P619
WHT
BLK
BRN
RED
PC6 J19
EHR-2
UL3265 AWG26 x 2
SHUTTER
E020
V-6190


P706
BRN
RED
EA24
PD LED⊕
PD LED⊖
PC7 J6
EHR-2
UL3265
AWG26 x2
J2401
R1
150
R2
150
D1 OLD2202
D2 OLD2202
BA24


P2204
GRY
BLK
EA46
PC22 J4
U/D M.⊕
U/D M.⊖
EHR-2
UL3265 AWG26 x 2
U/D MOTOR
E019
RB-35CW-CA045-24 1/29.55


P2205
UP LIMIT
GND
LO LIMIT
GND
BRN
RED
ORN
YEL
EA47
PC22 J5
EHR-4
UL3265 AWG26 x 4
NC
NO
UP/DOWN
UPPER LIMIT
UP/DOWN
LOWER LIMIT


P2206
RED
BLK
EA48
PC22 J6
R/L M.⊕
R/L M.⊖
EHR-2
UL3265 AWG26 x 2
R/L MOTOR
E032


AR-9A PC16
P2207
BRN
RED
ORN
YEL
EA49
PC22 J7
PI1 TLP801A
R
ORIGIN
PI2 TLP801A
C
ORIGIN

EHR-12

## • AR-600, AR-700 SERIES CONNECTOR TABLE

| | | | |
|---|---|---|---|
| PJ101 | 1 | SPD CHA | BLUE LINE |
| | 2 | SPD CHB | |
| | 3 | (DUMMY) | (OPEN) |
| | 4 | +10V | FLAT CABLE |
| | 5 | A GND | |
| | 6 | -10V | |

| | | | |
|---|---|---|---|
| PJ102 | 1 | MASK CHA | BLUE LINE |
| | 2 | MASK CHB | |
| | 3 | +10V | |
| | 4 | A GND | FLAT CABLE |
| | 5 | -10V | |

| | | | |
|---|---|---|---|
| PJ103 | 1 | +15V D | BRN |
| PJ702 | 2 | +15V D GND | RED |
| | 3 | VCC/+5V | ORN |
| | 4 | +5V GND | YEL |
| | 5 | +15V | GRN |
| | 6 | A GND | BLU |
| | 7 | -15V | VIO |
| | 8 | +12V | GRY |
| | 9 | +12V GND | WHT |
| | 10 | +5V D | BLK |

| | | A | B |
|---|---|---|---|
| PJ104 | 1 | D GND | D GND |
| PJ201 | 2 | +5V D | +5V D |
| | 3 | D0 | D1 |
| FLAT | 4 | D2 | D3 |
| RIBBON | 5 | D4 | D5 |
| | 6 | D6 | D7 |
| | 7 | WR0 | WR1 |
| | 8 | DISP MODE | B |
| | 9 | DISP SW1 | SW2 |
| | 10 | SW3 | SW4 |
| | 11 | SCAN0 | SCAN1 |
| | 12 | SCAN2 | SCAN3 |
| | 13 | EC1 | EC2 |
| | 14 | +5V D | +5V D |
| | 15 | A | D GND |

| | | A | B |
|---|---|---|---|
| PJ105 | 1 | PRINT PROG | P20 |
| PJ703 | 2 | P21 | P22 |
| | 3 | P23 | PRSTATUS |
| FLAT | 4 | +12V REMOTE | TH-EN |
| RIBBON | 5 | EXT TXD | EXT-RXD |
| | 6 | EXT DTR | EXT-DSR |
| | 7 | Voc | Voc |
| | 8 | GND | GND |

| | | A | B |
|---|---|---|---|
| PJ106 | 1 | +15V | SDUMPER |
| PJ601 | 2 | SPOT | -15V |
| | 3 | A GND | +5V D |
| FLAT | 4 | +5V D | +15V D |
| RIBBON | 5 | +15V D | +15V D |
| | 6 | S.M. | AR LED R |
| | 7 | AR LED L | D GND |
| | 8 | D GND | D GND |
| | 9 | MIR.MOTOR | LED L TMG |
| | 10 | LED R TMG | Voc |
| | 11 | Voc | GND |
| | 12 | GND | SOUT EN |
| | 13 | SOUT SCK | SOUT DATA |
| | 14 | SOUT LATCH | E2PROM CS |
| | 15 | SK | DI |
| | 16 | DO | RT.ORIGIN |
| | 17 | TG.ORIGIN | CH.ORIGIN |
| | 18 | CL1 ORIGIN | CL2 ORIGIN |
| | 19 | LED EN PW3 | LED SCK |
| | 20 | LED SO | LED LATCH |

| | | A | B |
|---|---|---|---|
| PJ107 | 1 | ø M1 | ø CCD1 |
| | 2 | ø SH1 | VIDEO1 |
| CCD1 | 3 | +5V A | +12V |
| | 4 | GND | A GND |
| | 5 | | |
| | 6 | ø M2 | ø CCD2 |
| CCD2 | 7 | ø SH2 | VIDEO2 |
| | 8 | +5V A | +12V |
| | 9 | GND | A GND |
| | 10 | | |

| | | A | B |
|---|---|---|---|
| PJ108 | 1 | SW1 | SW2 |
| J1201 | 2 | SW3 | SW4 |
| | 3 | SCAN5 | SCAN6 |
| FLAT | 4 | LOAD | DATA |
| RIBBON | 5 | CLOCK | |
| | 6 | GND | GND |
| | 7 | Voc | Voc |
| | 8 | | |

| | | | |
|---|---|---|---|
| PJ109 | 1 | VIDEO IN | |
| | 2 | GND | |
| | 3 | +12V | |
| | 4 | GND | |
| | 5 | HD | |
| | 6 | VD | |
| | 7 | GND | |
| | 8 | +5V(C) | |

| | | | |
|---|---|---|---|
| PJ110 | 1 | CARD DTR | BRN |
| PJ011 | 2 | CARD TXD | RED |
| | 3 | CARD DSR | ORN |
| | 4 | CARD RXD | YEL |
| | 5 | D GND | GRN |
| | 6 | +5V D | BLU |
| | 7 | | VIO |

| | | A | B |
|---|---|---|---|
| J111 | 1 | +15V D | D GND |
| J2201 | 2 | +15V D | D GND |
| | 3 | +15V D | D GND |
| | 4 | LED LATCH | LED SCK |
| FLAT | 5 | LED SO | TXD |
| RIBBON | 6 | DSR | SCK |
| | 7 | DTR | RXD |
| | 8 | ROTR/L | EC1EC2 |
| | 9 | VCC | HD |
| | 10 | VCC | VD |
| | 11 | VD | VCC |
| | 12 | +15V | GND |
| | 13 | +5V(C) | +5V(C) |
| | 14 | GND | GND |
| | 15 | VIDEO | GND |

| | | | |
|---|---|---|---|
| PJ112 | 1 | VIDEO OUT | WHT |
| P004 | 2 | GND | SHIELD |

(J001) MONITOR

| | | A | B |
|---|---|---|---|
| PJ113 | 1 | ø M3 | ø CCD3 |
| PJ2301 | 2 | ø SH3 | VIDEO3 |
| | 3 | +5V A | +12V |
| FLAT | 4 | GND | A GND |
| RIBBON | 5 | | |

| | | | |
|---|---|---|---|
| PJ202 | 1 | START SW A | BRN |
| | 2 | START SW B | GRN |
| | 3 | ENCODER 1 | BLU |
| | 4 | ENCODER 2 | WHT |
| | 5 | +5V D | YEL |
| | 6 | D GND | RED |

| | | | |
|---|---|---|---|
| PJ203 | 1 | SW1 | BRN |
| | 2 | SW2 | RED |
| | 3 | SW3 | ORN |
| | 4 | SW4 | YEL |
| | 5 | SCAN2 | GRN |

S.C.A. ENCODER

| | | | |
|---|---|---|---|
| PJ204 | 1 | G | BRN |
| | 2 | B | RED |
| | 3 | 5 | ORN |
| | 4 | A | YEL |
| | 5 | O | GRN |
| | 6 | | |
| | 7 | | |

| | | | |
|---|---|---|---|
| PJ602 | 1 | AR LED R | RED |
| | 2 | AR LED L | YEL |
| | 3 | D GND | WHT |

| | | | |
|---|---|---|---|
| PJ603 | 1 | S.M.+ | BLU |
| | 2 | S.M.- | BLK |

| | | | |
|---|---|---|---|
| PJ604 | 1 | -6.2V | SHIELD |
| | 2 | S.POT | RED |
| | 3 | +6.2V | WHT |

| | | | |
|---|---|---|---|
| PJ605 | 1 | MIR.MOTOR + | VIO |
| | 2 | MIR.MOTOR - | BLK |

| | | | |
|---|---|---|---|
| PJ606 | 1 | R.PM COM | YEL |
| | 2 | R.PM COM | WHT |
| | 3 | ø 1 | BLK |
| | 4 | ø 2 | RED |
| | 5 | ø 3 | GRN |
| | 6 | ø 4 | BLU |
| | 7 | P.I.A | BRN |
| | 8 | P.I.K | RED |
| | 9 | R.ORIGIN | ORN |
| | 10 | GND | YEL |

| | | | |
|---|---|---|---|
| PJ607 | 1 | T.PM.COM | YEL |
| | 2 | T.PM.COM | WHT |
| | 3 | ø 1 | BLK |
| | 4 | ø 2 | RED |
| | 5 | ø 3 | GRN |
| | 6 | ø 4 | BLU |

| PJ608 | 1 | P.I.A | BRN |
|---|---|---|---|
| | 2 | P.I.K | RED |
| | 3 | T.ORIGIN | ORD |
| | 4 | GND | YEL |

| PJ609 | 1 | CH.PM COM | BRN |
|---|---|---|---|
| | 2 | CH.PM COM | BRN |
| | 3 | ø 1 | RED |
| | 4 | ø 2 | BLU |
| | 5 | ø 3 | WHT |
| | 6 | ø 4 | ORN |
| | 7 | P.I.A | BRN |
| | 8 | P.I.K | RED |
| | 9 | CH.ORIGIN | ORN |
| | 10 | GND | YEL |

| PJ610 | 1 | CL1 PM COM | WHT |
|---|---|---|---|
| | 2 | CL1 PM COM | WHT |
| | 3 | ø 1 | BLU |
| | 4 | ø 2 | YEL |
| | 5 | ø 3 | GRN |
| | 6 | ø 4 | RED |
| | 7 | CL2 PM COM | WHT |
| | 8 | CL2 PM COM | WHT |
| | 9 | ø 1 | BLU |
| | 10 | ø 2 | YEL |
| | 11 | ø 3 | GRN |
| | 12 | ø 4 | RED |

| PJ611 | 1 | CL1 LED A | BRN |
|---|---|---|---|
| | 2 | CL1 LED K | RED |
| | 3 | CL1 ORIGIN | ORN |
| | 4 | GND | YEL |
| | 5 | CL2 LED A | GRN |
| | 6 | CL2 LED K | BLU |
| | 7 | CL2 ORIGIN | VIO |
| | 8 | GND | GRY |

| PJ613 | 1 | ALIGN.LED A | ORN |
|---|---|---|---|
| | 2 | ALIGN.LED K | BLK |

| PJ614 | 1 | ILLUMI.LED A | RED |
|---|---|---|---|
| | 2 | D GND | BLK |

| PJ615 | 1 | LED1 A (R) | BRN |
|---|---|---|---|
| | 2 | LED1 K | RED |
| | 3 | LED2 A (U) | ORN |
| | 4 | LED2 K | YEL |
| | 5 | LED3 A (L) | GRN |
| | 6 | LED3 K | BLU |
| | 7 | KED4 A (D) | VIO |
| | 8 | LED4 K | GRY |

| PJ616 | 1 | MIRE LED A | BRN |
|---|---|---|---|
| | 2 | MIRE LED A | RED |
| | 3 | MIRE LED K | BLK |

| PJ617 | 1 | VCC | WHT |
|---|---|---|---|
| | 2 | CHART LAMP | BLK |

| PJ18 | 1 | +5V D |
|---|---|---|
| | 2 | GLARE LAMP |
| | 3 | +5V D |
| | 4 | GLARE LAMP |

| PJ619 | 1 | +5V D | WHT |
|---|---|---|---|
| | 2 | SHUTTER | BLK |

| PJ701 | 1 | AC14V | YEL |
|---|---|---|---|
| | 2 | AC14V | YEL |
| | 3 | AC18V | BLK |
| | 4 | AC18V | BLK |
| | 5 | AC18V | BRN |
| | 6 | AC18V | BRN |
| | 7 | AC18V | RED |
| | 8 | AC18V | RED |
| | 9 | AC10V | ORN |
| | 10 | AC10V | ORN |

| | | A | B |
|---|---|---|---|
| PJ704 | 1 | PR.PROG. | P20 |
| | 2 | P21 | P22 |
| | 3 | P23 | HOME SW/PRSTATUS |
| FLAT | 4 | TH.TRIG. | TH.EN. |
| RIBBON | 5 | +5V (PM) | +5V(PM) |
| | 6 | +5V | +5V |
| | 7 | GND | GND |
| | 8 | | |

| | | | |
|---|---|---|---|
| PJ705 | 1 | TXD | BRN |
| | 2 | RXD | RED |
| | 3 | DTR | ORN |
| | 4 | DSR | YEL |
| | 5 | S.GND | GRN |

| | | | |
|---|---|---|---|
| PJ706 | 1 | PD LED + | RED |
| | 2 | PD LED - | BLD |

| | | SER.PRINTER | LIN PRINTER |
|---|---|---|---|
| PJ802 | 1 | GND | ③ P.I.C |
| | 2 | HOME SW | ② P.I.E.K |
| | 3 | H.PM COM | ① SW.P.I.A |
| | 4 | H.PM COM | SW |
| | 5 | H.PM ø 1 | VH |
| | 6 | ø 2 | VH |
| | 7 | ø 3 | DATA IN |
| | 8 | ø 4 | B.E.O. |
| | 9 | TH1 | LATCH |
| FLEX | 10 | TH2 | CLOCK |
| WIRE | 11 | TH3 | STB6 |
| | 12 | TH4 | STB5 |
| | 13 | TH5 | STB4 |
| | 14 | TH6 | STB3 |
| | 15 | TH7 | STB2 |
| | 16 | TH8 | STB1 |
| | 17 | TH COM. | $GND_H$ |
| | 18 | P.PM COM. | $GND_H$ |
| | 19 | P.PM COM. | $GND_H$ |
| | 20 | P.PM ø 1 | $GND_H$ |
| | 21 | ø 2 | $GND_L$ |
| | 22 | ø 3 | $V_{DD}$ |
| | 23 | ø 4 | T2 |
| | 24 | | T1 |
| | 25 | | THERMISTOR |
| | 26 | | THERMISTOR |
| | 27 | | B |
| | 28 | | B |
| | 29 | | A |
| | 30 | | A |
| | 31 | | $V_H$ |
| | 32 | | $V_H$ |

| | | | |
|---|---|---|---|
| PJ2202 | 1 | VIDEO IN | WHT |
| PJ004 | 2 | VIDEO GND | SHIELD |
| CAMERA | 3 | NC | WHT |
| | 4 | GND | WHT |
| | 5 | HD | WHT |
| | 6 | VD | WHT |
| | 7 | GND | WHT |
| | 8 | +5V(C) | WHT |

| | | | |
|---|---|---|---|
| PJ2203 | 1 | DC | WHT |
| | 2 | DC GND | WHT |
| | 3 | FI | WHT |
| | 4 | C.SYNC | WHT |
| | 5 | GND | WHT |

| | | | |
|---|---|---|---|
| PJ2204 | 1 | U/D M. + | GRY |
| | 2 | U/D M. - | BLK |

| | | | |
|---|---|---|---|
| PJ2205 | 1 | UPLIMIT | BRN |
| | 2 | GND | RED |
| | 3 | DOWN LIMIT | ORN |
| | 4 | GND | YEL |

| | | | |
|---|---|---|---|
| PJ2206 | 1 | R/L M. + | VIO |
| | 2 | R/L M. - | BLK |

| | | | |
|---|---|---|---|
| PJ2207 | 1 | P.I.A | BRN |
| | 2 | P.I.K | RED |
| | 3 | R LIMIT ORIGIN | ORN |
| | 4 | GND | YEL |
| | 5 | P.I.A | BRN |
| | 6 | P.I.K | RED |
| | 7 | C LIMIT ORIGIN | ORN |
| | 8 | GND | YEL |
| | 9 | | |
| | 10 | | |
| | 11 | | |
| | 12 | | |

| | | A | B |
|---|---|---|---|
| PJ2301 | 1 | ø M | ø CCD |
| | 2 | ø SH | VIDEO OUT |
| FLAT | 3 | +5V A | +12V |
| RIBBON | 4 | GND | A GND |
| | 5 | | |

| | | | |
|---|---|---|---|
| PJ005 | 1 | +12V | GRY |
| MONITOR | 2 | | |
| | 3 | | |
| | 4 | GND | WHT |

| Error Code | Indication | | Contents | Details |
|---|---|---|---|---|
| | With code | Without code | | |
| 1 | Err | Err 1 | Sensor error | The distance the sensor moves is abnormal. |
| 2 | Err | Err 2 | Target error | The target limit SW does not work. |
| 3 | Err | Err 3 | Rotator error | The rotator limit SW does not work. |
| 4 | Err | Err 4 | Chart error | The chart sensor does not work. |
| 5 | Err | Err 5 | CL1 error | The cylinder lens 1 sensor does not work. |
| 6 | Err | Err 6 | CL2 error | The cylinder lens 2 sensor does not work. |
| 7 | Err | Err 7 | Printer error | Paper is lack or the paperweight is lift up. (When the line printer is used.) |
| 8 | Err | Err 8 | Printer error | The HOME SW does not work. (When the serial printer is used.) |
| 9 | Err | Err 9 | E2PROM error | E2PROM data is broken. |
| A | Err | Err a | RAM error | RAM backup data is broken. |
| B | Err | Err b | TV camera error | Synchronized signal does not appear. |
| C | Err | Err c | PC22 communication error | Cannot communicate with PC22 board. |
| D | Err | Err d | Clock error | Clock data is abnormal. |
| 11 | Err IF | Err 11 | DSR error (OUT) | Data is not set ready when SD command is received. |
| 12 | Err IF | Err 12 | DSR error (OUT) | Data is not set ready when data is sent. |
| 13 | Err IF | Err 13 | Data error (OUT) | Data cannot be received. |
| 14 | Err IF | Err 14 | Overflow (OUT) | The receive buffer is full. |
| 15 | Err IF | Err 15 | Command error (OUT) | An illegible command is input. |
| 16 | Err IF | Err 16 | Data emptiness (OUT) | There is no data to send. |
| 18 | Err IF | Err 18 | DSR error (IN) | Data is not set ready when SD command is received. |
| 19 | Err IF | Err 19 | DSR error (IN) | Data is not set ready when data is sent. |
| 1A | Err IF | Err 1a | Data error (IN) | Data cannot be received. |
| 1B | Err IF | Err 1b | Overflow (IN) | The receive buffer is full. |
| 1C | Err IF | Err 1c | Command error (IN) | An illegible data is input. |
| 81 | Err | Err 81 | Blink error | Mask signal blink error |
| 82 | Err | Err 82 | Blink error | Mask signal blink error 2 |
| 83 | Err | Err 83 | Blink error | SGRAD corrugation blink error |
| 84 | Err | Err 84 | SGRAD error | Slope coefficient error |
| 85 | Err | Err 85 | Blink error | Mask signal blink error in the real measurement |
| 86 | Err | Err 86 | Blink error | Measuring corrugation blink error in the real measurement |
| 87 | Err | Err 87 | Blink error | The go-and-return measurement blink error |
| 88 | Err | Err 88 | Alignment error | The alignment is out of position after AR measurement. |
| 91 | Err +0 | Err 91 | SPH + over | +23 D or more (VD=12mm) |
| 92 | Err -0 | Err 92 | SPH – over | –18 D or more (VD=12mm) |
| 93 | Err co | Err 93 | CYL over | 8 D or less (VD=12mm) |
| 94 | Err | Err 94 | Confident coefficient error | |
| A1 | ERROR | ERROR A1 | CCD light-lack error | Measuring light does not enter CCD. |
| A2 | ERROR | ERROR A2 | CCD edge-lack error | The number of X or Y CCD measuring light is 2 or less. |
| A3 | ERROR | ERROR A3 | CCD edge-overmuch error | The number of X or Y CCD measuring light is 5 or more. |
| A4 | ERROR | ERROR A4 | CCD corrugation error | The width of the measuring light is too wide. |
| A6 | ERROR | ERROR A6 | CCD edge number error | The numbers of X and of Y CCD measuring light are different. |
| B1 | ERROR | ERROR B1 | R (corneal curvature) + over | 10.06 mm or more |
| B2 | ERROR | ERROR B2 | R (corneal curvature) - over | 4.94 mm or less |
| B3 | ERROR | ERROR B3 | CYL (cornea) over | 10.00 D or more |
| C1 | ERROR | ERROR C1 | Sagittal number lack error | The number of sagittal value to calculate the eccentricity is lack. |

※ Error code 9 and A are also printed out.

9: Memory Failure on E2PROM

A: Memory Failure on RAM

* Specifications are subject to change without notice for improvement.

# NIDEK CO., LTD.


| | |
|---|---|
| **NIDEK CO., LTD.**<br>**(Manufacturer)** | : 34-14, Maehama, Hiroishi-cho, Gamagori, Aichi 443-0038, Japan<br>Telephone: (0533) 67-6611<br>Facsimile: (0533) 67-6610 |
| **NIDEK CO., LTD**<br>**(Tokyo Office)** | : 6th Floor, Takahashi Bldg., No.2, 3-chome, Kanda-jinboucho<br>Chiyoda-ku, Tokyo 101-0051, Japan<br>Telephone: (03) 3288-0571<br>Facsimile: (03) 3288-0570<br>Telex: 2226647 NIDEK J |
| **NIDEK INCORPORATED**<br>**(United States Agent)** | : 47651 Westinghouse Drive Fremont, California 94539, U. S. A.<br>Telephone: (510) 226-5700<br>Facsimile: (510) 226-5750 |
| **NIDEK SOCIETE ANONYME**<br>**(Authorized Representative)** | : Europarc 13, rue Auguste Perret, 94042 CRETEIL, France<br>Telephone: (01) 49 80 97 97<br>Facsimile: (01) 49 80 32 08 |